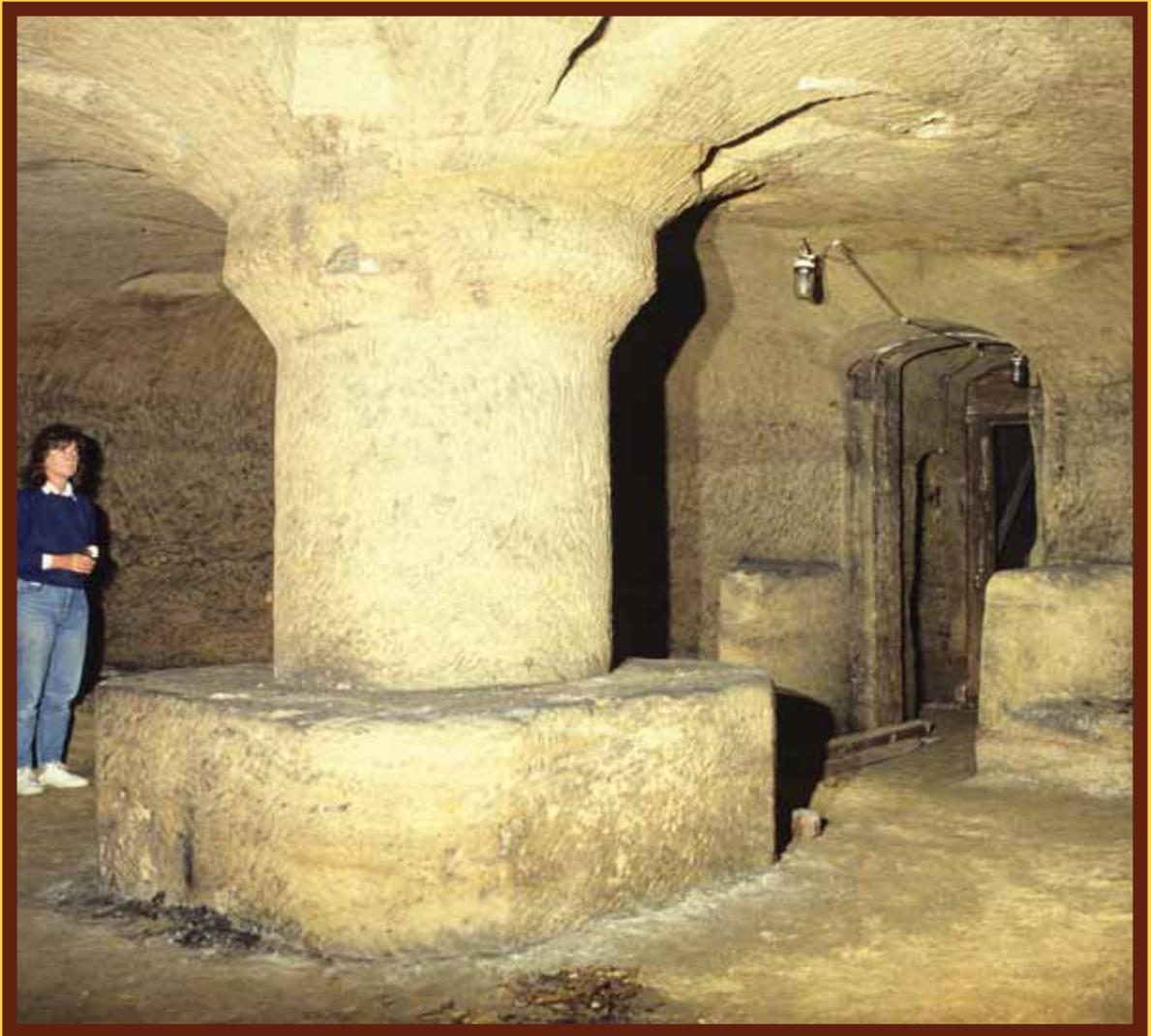


Sandstone Caves of Nottingham



Tony Waltham

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of
Nottingham**

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2008

East Midlands Geological Society

Nottingham

Sandstone Caves of Nottingham

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The author is grateful to Jenny Walsby, Alan MacCormick, Douglas Whitworth and Andrew Rigby for welcome and generous assistance during the preparation of this text.

Photographs (except page 11) are by the author, largely with the assistance of his wife, Jan.

The cave maps were all drawn by the author, mostly from his own surveys, which were completed with many assistants; they illustrate the main morphology and features of the caves, and are not intended to be surveys of engineering grade.

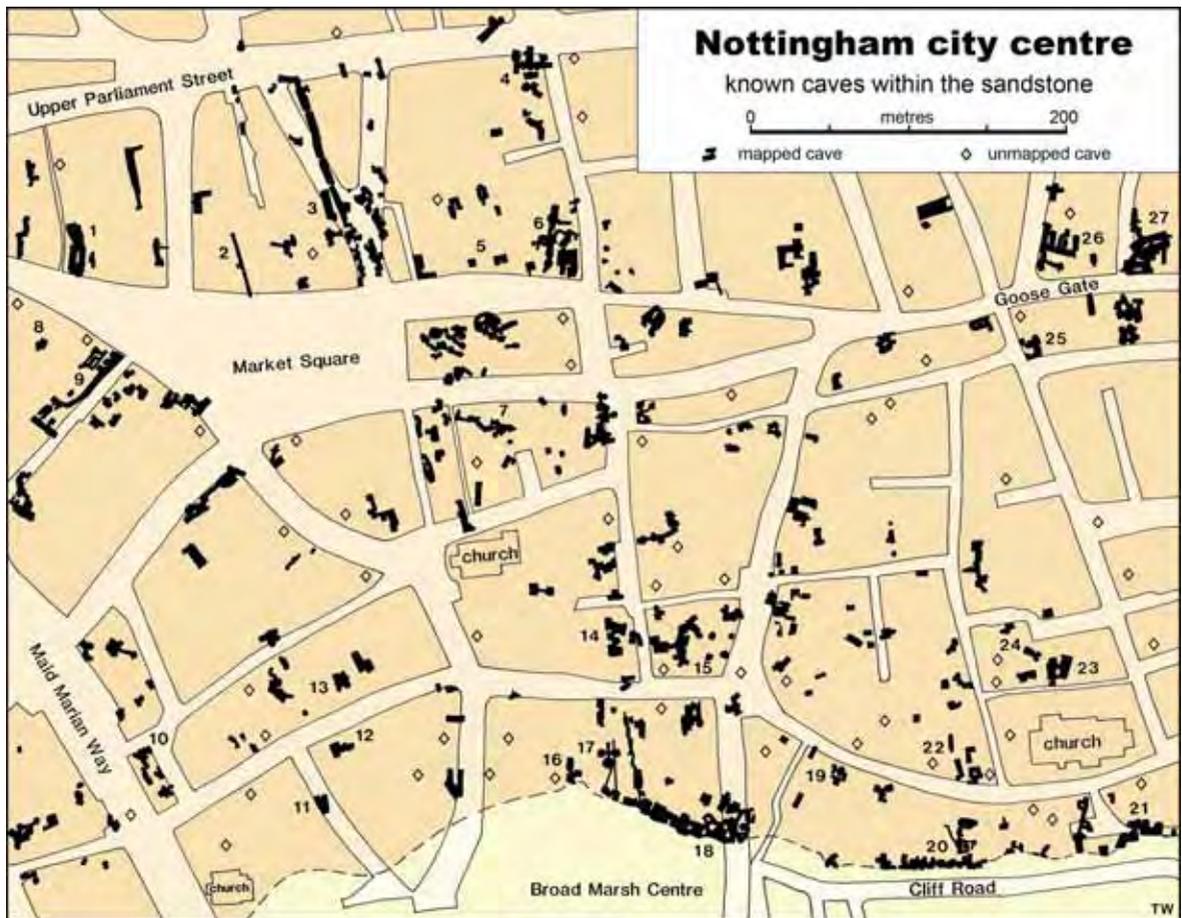
An up-dated listing of the key source material and references on the Nottingham caves is published in the 2008 issue (Volume 17, Number 1) of the *Mercian Geologist*.

Sandstone Caves of Nottingham

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Cover photographs:
 Front: Wine cellar cave below Willoughby House
 Back: Mortimer's Hole and caves in Castle Rock





Map of the caves under the city centre

The caves of central Nottingham as they are known today, located with reference to the modern pattern of streets. Some of the unmapped caves are only located approximately, because their details are unknown. There are certainly many more caves that lie concealed, have been forgotten or remain unmapped; some of the mapped caves have already been destroyed or filled with concrete. Across the southern edge of the city centre, the sandstone of the high ground is lost beneath the alluvium of the floodplain (marked in yellow) - which is therefore the southern limit of the caves. Numbers identify caves that are referred to in the text.

- 1 = Pearsons;
- 2 = Debenham's;
- 3 = Queen Street;
- 4 = Corner Pin;
- 5 = Black Boy;
- 6 = Lion Hotel;
- 7 = Flying Horse;
- 8 = Bromley House;
- 9 = Hickling Laing's;

- 10 = Salutation;
- 11 = Stanford Street;
- 12 = 17 Castle Gate;
- 13 = Castle Gate malt kiln;
- 14 = Bridlesmith Gate;
- 15 = Middle Pavement;
- 16 = Black's Head;
- 17 = Willoughby House;
- 18 = Drury Hill;

- 19 = Garner's Hill;
- 20 = Shire Hall;
- 21 = Commerce Square;
- 22 = Cock and Hoop;
- 23 = Plumptre House;
- 24 = Plumptre malt kiln;
- 25 = Old Angel;
- 26 = Jalland's;
- 27 = Adams' Brewery.

Sandstone Caves of Nottingham

City of caves

Hundreds of caves lie in the sandstone beneath the offices, shops, houses and factories of Nottingham's city centre. They are all man-made, largely dug out of the rock to provide underground space in a crowded urban area; they became cellars, factories and storerooms of all sorts. A few were turned into dwellings, and a few were mines - excavated to produce the sand that was a valued commodity in years gone by. None of the caves was cut by natural erosion.

Nottingham has so many caves quite simply because the physical properties of the bedrock sandstone are ideal for its excavation. All the caves are in the red and buff Sherwood Sandstone, which is easily excavated with only hand tools, yet will safely stand as an unsupported arch of low profile. Even back in Saxon times, Nottingham was known for its caves, though the great majority of those which survive today were cut much more recently. Local folklore about the caves has often far outstripped reality; but, even in the cold light of truth, Nottingham still has more man-made caves than anywhere else in Britain.

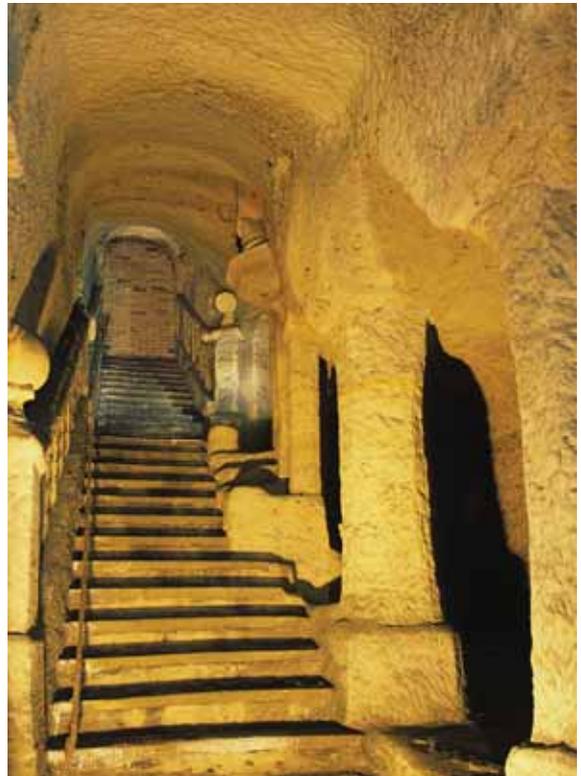
Nottingham's bedrock foundation

The inner city of Nottingham lies on the outcrops of just three rock units. The oldest and lowest is the Lenton Sandstone, which forms the lower part of the Sherwood Sandstone; it consists of a red-and-yellow-mottled, fine-grained sandstone and is about 30 m thick. In the middle of the rock sequence, the upper part of the Sherwood Sandstone is the Nottingham Castle Sandstone, consisting of coarser, buff coloured sandstones around 60 m thick. Overlying the Sherwood Sandstone to the east is the outcrop of younger rock, the Mercia Mudstone, which includes the siltstones and fine sandstones once known as the Waterstones.

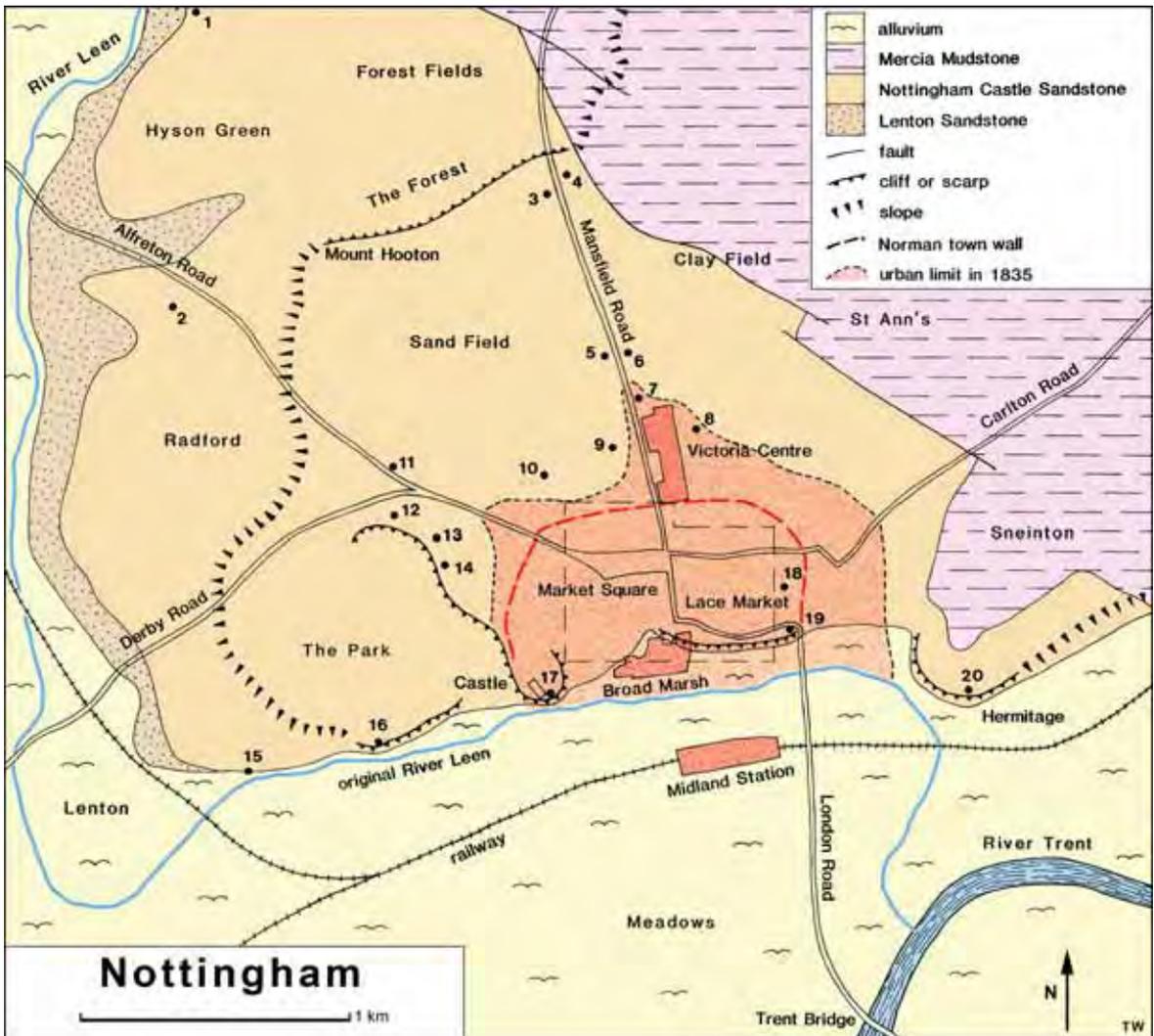
The staircase cut into the sandstone, as a replica of one in Haddon Hall, to provide the main entrance to the caves in Thomas Herbert's Victorian garden.

All of these rocks were formed as flash flood sediments in desert basins during Triassic times, about 240 million years ago, when Britain was part of a hot and dry continental interior close to the equator. Subsequent eons of plate tectonic movements have brought Britain to its present position; and during the same time, the desert sediments have been, buried, compressed and cemented to form moderately strong sedimentary rocks. Uplift and erosion have exposed these at the surface around Nottingham, and all the rocks dip to the east at about 1° below the horizontal.

The low ground south of the city centre is formed on the alluvium of the Trent and Leen valleys, which is mostly sandy clay and is less than 10 m thick. This was deposited on the natural floodplains before the rivers were constrained to their modern channels by artificial levees and embankments. No caves lie beneath the alluvium, because any excavations would be flooded beneath the shallow water table.



SANDSTONE CAVES OF NOTTINGHAM



The outcrop of the Nottingham Castle Sandstone and the other rocks under the inner part of Nottingham, with the main topographical features and some features of the city's growth, including just some of the old main roads. The town limit of 1835 is generalised, as there was also some ribbon development along the main roads, and Sneinton, Lenton, Hyson Green and Radford were already established as separate villages. The whole of the area on the map is now covered by urban development. The River Leen was diverted in 1964 into a culvert from the bend south of Lenton directly into the Trent. No surface features remain from the Norman town wall. The broken line frames the area shown in the city centre map on page 4. Numbered spots locate caves referred to in the text and lying outside the city centre map; there are many other outlying caves that are not marked.

- 1 = Shipstone's Brewery;
- 2 = Player's;
- 3 = Cemetery Mine;
- 4 = Gallows Hill Mine;
- 5 = Rouse's mine;
- 6 = Whiston mines;
- 7 = Nottingham Brewery;
- 8 = St Ann's malt kiln;
- 9 = Guildhall;
- 10 = Burton's store;
- 11 = Running Horse;
- 12 = Newcastle Drive;
- 13 = Park Tunnel;
- 14 = Thomas Herbert's;
- 15 = Castle Boulevard cistern;
- 16 = Lenton Hermitage;
- 17 = Castle Rock;
- 18 = Bellward Gate cistern;
- 19 = Hollow Stone;
- 20 = Sneinton Hermitage.

SANDSTONE CAVES OF NOTTINGHAM

The city of Nottingham originated on, and then spread over, the sandstone high ground immediately north of the Trent floodplain; essentially this is the very gently dipping escarpment of the Sherwood Sandstone, with the Nottingham Castle Sandstone forming most of the outcrop. Westward, the scarp face descends across the Lenton Sandstone outcrop into the Leen valley. Southward, the fault line scarps which originally truncated the sandstone escarpment have been cut back by lateral expansion of the Trent valley; this has left steep slopes and cliffs along the floodplain margin, most notably at Castle Rock and Sneinton Hermitage, with the former reaching to 40 m above the floodplain.

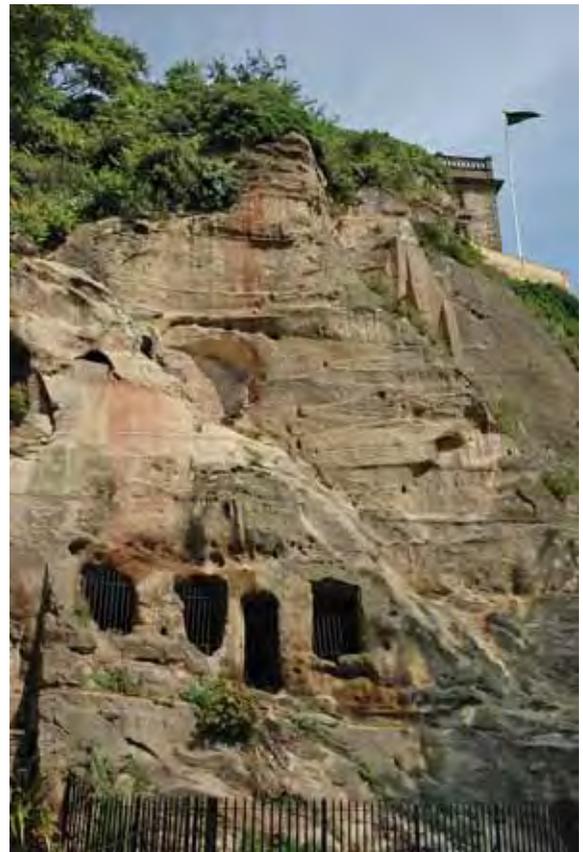
Nearly all the caves are cut in the Nottingham Castle Sandstone. This consists largely of poorly sorted, medium to coarse grains of quartz sand; a small iron oxide content gives the rock an overall buff colour. There are many scattered pebbles of tough quartzite and also numerous flakes of red mudstone; both the pebbles and the flakes are locally concentrated into thin layers of conglomerate (the rock unit was earlier known as the Bunter Pebble Beds). Much of the rock has some degree of cross bedding, although bedding planes are generally not conspicuous.

The sandstone can only be described as a weak, friable rock, because its unconfined compressive strength is generally around 5 MN (concrete is about five times stronger). Its strength is low largely because it relies on a weak clay cement as a binder between the quartz grains. This clay cement also accounts for the substantial reduction in strength when the sandstone is saturated, with implications on the rock's durability and the caves' stability.

Though the sandstone is weak, it is also distinguished by its notable lack of fractures. Joint spacing, as revealed on the cliff outcrops, is generally in excess of 10 m, and very few joints are encountered within the caves. Combined with the scarcity of bedding planes, this lack of structural weakness ensures the stability of the cave roof spans. The soft rock with few fractures is ideal for cave excavation - and explains why the city of Nottingham has such a very large number of man-made caves within its boundaries.

Natural weathering causes the Nottingham Castle Sandstone to disintegrate ultimately to a loose, granular sand, which then forms the first few metres beneath the ground surface. Partial weathering also produces a steady decline in the rock strength in the last 10 m towards the surface. Conditions can vary locally, but across much of the city centre, sound rock is encountered at depths of 2-5 m, unless there is an unusually large thickness of artificially placed sand or rubble fill.

Although natural caves in sandstone do occur elsewhere in the world, no processes of natural cave formation have been active in the Nottingham outcrops. Even along the old river cliffs south of the city centre, there are no caves that have been created through undercutting by the river. The story of the caves is the story of man's occupation and industry over a thousand years of the evolution of Nottingham.



Rock House Cave in Castle Rock, cut into sandstone at the type locality beneath Nottingham Castle.

History of the caves

High ground close to a river crossing is one of the classic sites for primary settlement. Nottingham is of this type, and the oldest part of town lies on the sandstone shoulder now occupied by the Lace Market district. In Saxon times a permanent structured settlement covered an area 300 m by 500 m, surrounded by a ditch and rampart, except along the southern side where the old river bluffs provided a defensive boundary. Originally these bluffs were a mixture of steep slopes and rock cliffs, but many of the modern cliffs are the result of more recent artificial modification. The site was known as the village of the Snotingas people; hence the name Snotingaham, though the spelling has since evolved and the S has fortunately been lost. In AD 868, King Alfred's chronicler, a Welsh monk known as Asser, referred to an older British name for the settlement; this was Tiggucobaucc, which means the place of caves,

and suggests that some residents may have by then found a use for sandstone excavations as an alternative to wooden surface structures.

Nottingham grew again when the Normans built a castle on the hill west of the Saxon town and settled the land between. The Saxon and Norman towns coalesced, and the Norman wall and ditch enclosed the whole site except along the river cliffs on the south side. This boundary defined the town for many centuries, and the great majority of the sandstone caves lie within it, as most were cut during this period of urban evolution. Pottery from the period 1250-70, found in the caves of Castle Gate and Drury Hill provides the earliest proven dates for Nottingham's caves; and clearly the cave excavation pre-dated the pottery. The existence of caves much before that date cannot be proven, though it is almost certain that some of Nottingham's caves do date back to pre-Norman times, even if they have since been modified beyond recognition.



Pillar Cave within the complex of caves under the old Drury Hill. A flared pillar supports an unusually wide roof, and the cave is now preserved within The City of Caves tourist site beneath the Broad Marsh Centre.

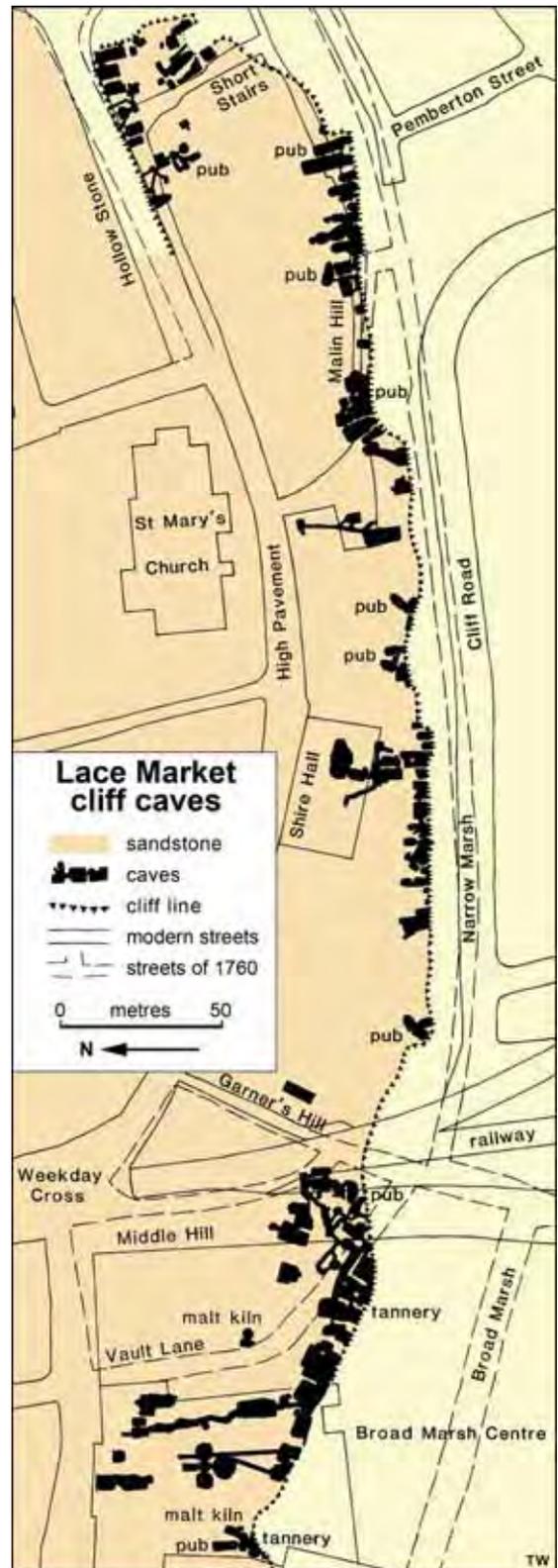
SANDSTONE CAVES OF NOTTINGHAM

Many of the older caves have been destroyed, and many more may lie buried and awaiting future re-discovery, but it is estimated that there were more than 100 caves in Nottingham prior to 1600. The great majority of the caves date from the period 1600-1900. Construction dates and visitor's descriptions are documented for many of the caves, and from those undocumented, archaeological excavations have yielded a wealth of 18th century pottery.

Through the centuries, the population of Nottingham grew, but the size of the town did not keep pace. By 1841, there were 53,000 people crowded into an area little more than that of the Norman town. Generally low quality, and very crowded, housing had stretched beyond the Norman town boundary, along both sides of Mansfield Road (houses that were largely demolished when Victoria Station was built), onto the wet floor of the lower St Ann's valley, and also onto the Broad Marsh and Narrow Marsh areas between the old sandstone cliffs and the original course of the River Leen.

Any further expansion was prevented by the strict constraints against building on any of the Freemans' fields, which were effectively commons. North of the town, the Sand Field and Clay Field were distinguished by their soils derived from the Sherwood Sandstone and Mercia Mudstone respectively; the privately owned Park lay to the west. These constraints on building disappeared with the passing of the Enclosure Acts in 1845. Houses and factories rapidly spread northward up the sandstone slope, and eventually saw the demise of the windmills along the Mount Hooton scarp, though much of the Park was not covered with houses until after 1870. The late 19th century saw the cutting of most of the caves that lie outside the Norman

Outline map of the known caves cut into the sandstone cliffs along the southern edge of the Lace Market, together with the old and modern street lines. Only those caves which are entered from the cliff face are marked. Caves labelled "pub" are those with barrel thralls, recognisable as old public house cellar caves, though all the pub buildings (except for the Loggerheads) have been demolished. Vault Lane subsequently changed its name to Drury Hill.



SANDSTONE CAVES OF NOTTINGHAM

town limits, though these were fewer in number, and generally larger, than their predecessors beneath the old town. No caves lie south of the old town, because there the sandstone is beneath the water table in the Trent Valley.

A final phase of cave excavation was for wartime air raid shelters, but by 1900 the pattern of the Nottingham caves was largely complete. Subsequently many caves have been filled, destroyed, lost or forgotten, but the caves currently known are distributed across and beneath the entire city centre. It would be a fair assumption that every building or site within the old city limits either has or had some form of cave beneath it. About 500 caves are now known, and this may be only half the total number that have been excavated under Nottingham. Many caves were completely removed when basements of later houses or factories were cut deeper into the rock, so that no traces remain. Many other caves have lost their entrances; these await rediscovery - which is commonly when building demolition and new development of the site are in progress. The Market Square and the sites of the churches are probably the only large chunks of ground in Nottingham that are devoid of caves.

Dark underground holes are fertile breeding sites for myths and rumours. Fanciful stories about Nottingham's caves far outdistance reality. Druidical remains have been spoken of and have appeared on some old maps - but such a religious connection has no supporting evidence. Caves 2000 years old, with underground forests and farms are pure fairy tale. The most widespread myths are of long tunnels beneath the city. Anecdotes are often told concerning long underground journeys, but always rely on "a friend of my grandfather" or "someone who lived here before" as their source. Most popular are stories of a cave from Mansfield Road to the Castle, perhaps because both sites do have quite extensive caves, but the link does not exist. Even wilder are the stories of a cave from the Castle to Wollaton Hall - which would have offered a very wet journey beneath the water table of the Leen Valley. There are not, and never were, any such long tunnels under Nottingham. The caves are isolated features, and there is no great "system" of caves. With few exceptions, each cave or cave group was excavated beneath its owner's land; most underlie a single building.



A fine small cave recently found under a house on Forest Road. The sandstone partitions between the alcoves along the walls are typical of a wine vault, and the large central table has a top of natural flagstone standing on columns of brick.

Cave dwellings and rock houses

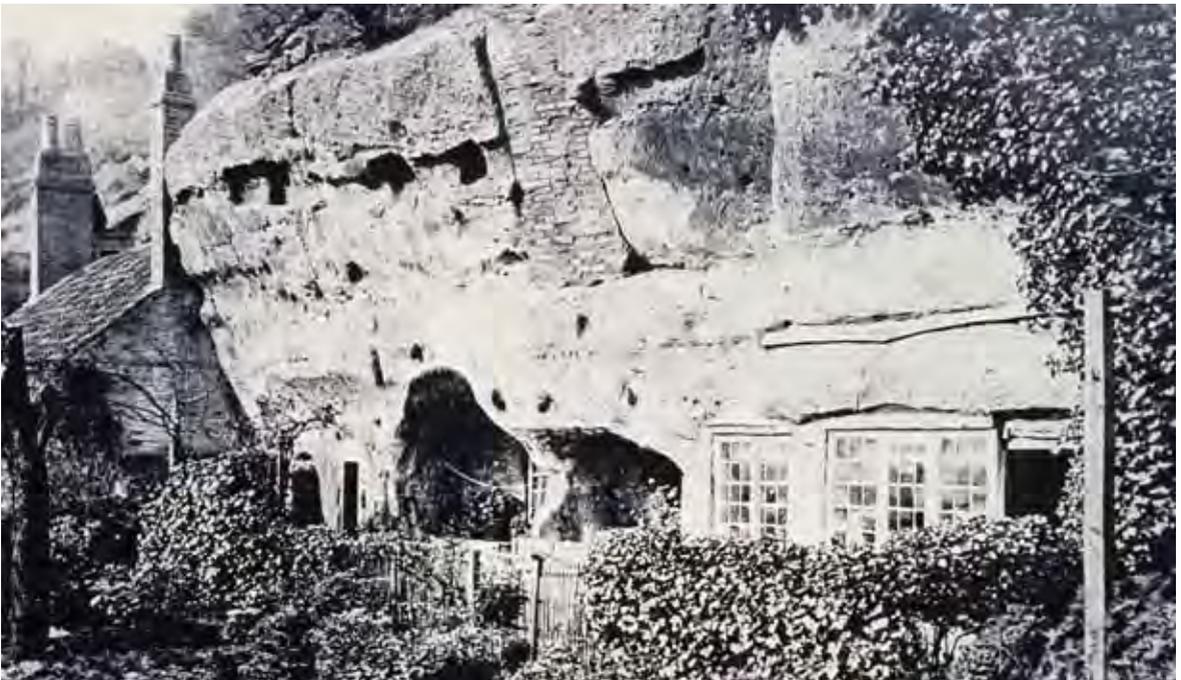
The caves of Nottingham could provide acceptable and convenient sites for dwellings in years gone by, but were readily abandoned when brick and cut timber made conventional houses so much more comfortable. Some caves can be dated back to 1250. The Saxon chronicles of Asser record caves in the Town 400 years earlier, but there is no archaeological proof of any particular site. It is certainly reasonable to assume that cave houses did exist in Nottingham at the earlier Saxon date, but the particular caves have very likely been subsequently destroyed or modified beyond recognition.

A feature of all the known cave houses is that they were entered horizontally into steep slopes or cliffs of the sandstone; this is in contrast to the greater numbers of cave store rooms and utility rooms, which were mostly cut at later dates and which were entered down flights of steps from level ground. There are travellers' tales from 1610 and 1639 of many or most of the people of Nottingham living underground; but the town contained only a limited number of sites where horizontal entry was possible, and these early reports are probably exaggerated.

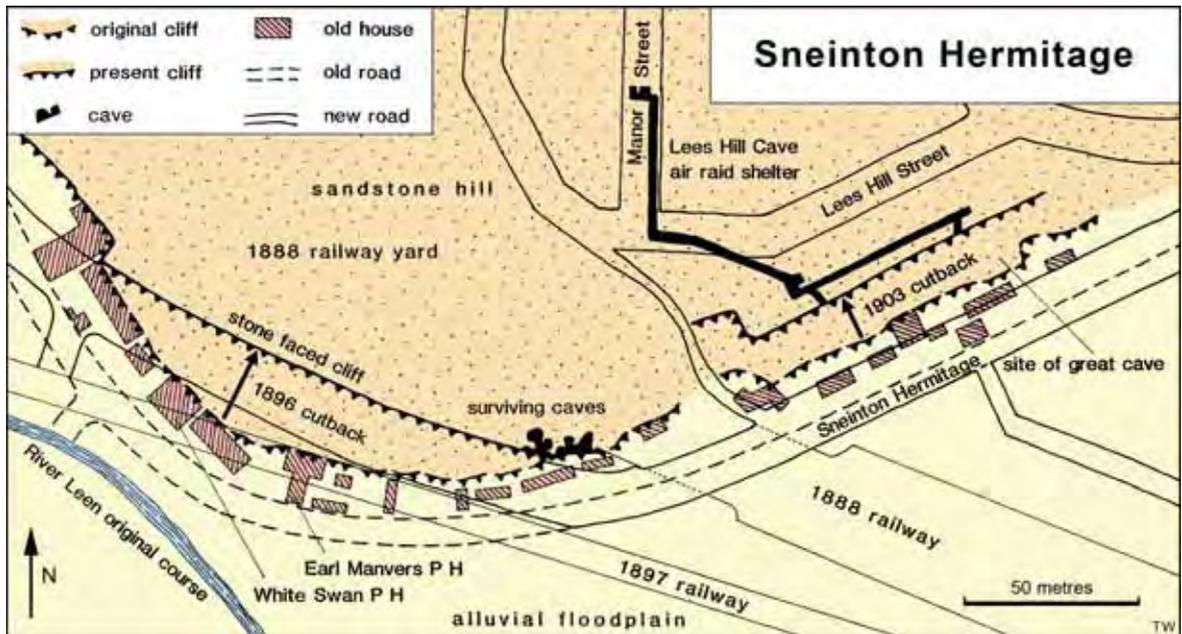
The largest group of rock houses was at Sneinton Hermitage, east of the old town. More than 300 m of sandstone cliff faced onto the floodplain, with the original River Leen flowing by very close to its western end. Cave houses were cut into the cliff along its entire length, but nearly all were lost when the cliff line was cut back a century ago. Records of the rock houses reach back to 1518, and some were inhabited at least as late as 1867. The few surviving rock houses are probably typical of most. Each room is no more than 3 m across, and reaches back less than 10 ms from the cliff face. Shelves and niches are cut into the rock, and, where caves lead through from one to another, carefully sited openings ensure daylight reaches the inner recesses. Old photographs show that they had glazed windows, doors and chimneys.

Some of the Sneinton Hermitage caves were larger. They were on two levels high behind the public houses, and included a dance hall at the back of the Earl Manvers before it was destroyed by a rockfall in 1829. The great cave nearer the

Cave houses cut into a sandstone cliff, believed to be some of those at Sneinton Hermitage in about 1895, just before their destruction to build the new railway.



SANDSTONE CAVES OF NOTTINGHAM



eastern end of the cliff was 11 m across, roughly circular, and 6 m high, with six rock columns supporting the sandstone roof. Sadly the Hermitage caves did not survive the onslaught of the railways. The middle of the cliff was destroyed in 1888 when the railway reached in to a yard built on a terrace cut in the rock of Lees Hill directly behind the Hermitage. Worse was to follow; all the western caves were destroyed in 1896 when the cliff was cut back to accommodate the new road displaced by another railway at a lower level. Then the eastern caves were all destroyed in 1903 when that part of the cliff was cut back to allow new houses alongside a widened road. The air raid shelter cave was cut even later and has no relation to what was a splendid group of rock houses. Today the railways are also gone.

At various times, rock houses may have been cut into the foot of the cliffs round much of Castle Rock. The main group is still visible with their entrances bricked up along Castle Road, though all of these appear to have been expanded into storage caves, and there are no remaining features of caves that were houses. The Castle Rock caves include those now at the back of the Trip to Jerusalem Inn; an upper cave over the inn has a uniquely surviving window frame set in the rock,

Past and present features of Sneinton Hermitage. Caves were cut into the whole length of the original cliff, but were nearly all destroyed in three phases of railway construction and road widening. The site of the great cave is only known approximately.

though this was probably a late addition to a much older cave. Window openings and a doorway identify Rock House, clearly visible from Peveril Drive, but its origin is unknown.

West of the Castle, the low cliff between the southern edge of The Park and Castle Boulevard contains the very old caves that are inappropriately known as the Lenton Hermitage. They included the chapel of St Mary de la Roche, and were the property of Lenton Priory (founded soon after 1100). Another cave was used as a dovecote. Two monks were recorded living in the caves in 1244, but that is about the extent of their role as a hermitage. The whole site was sacked by Roundhead soldiers in 1651, and the caves were further modified when the site became a Victorian leisure garden in the 1800s. One cave was in use as an office until the 1960s. They all now lie behind the apartment blocks of Park Rock, where both the cliff face and the caves have been commendably conserved; one remains in use as a cycle shed.

The fourth bluff along the floodplain margin, that below the Lace Market, has caves along its entire

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length. It is probable that cave houses have existed here at some time in the past, but no convincing traces remain. West of Middle Hill, the caves are all preserved, but consist largely of pub cellars and the tanneries. To the east, the cave entrances along the foot of the cliff are largely bricked up, though recent access to some and good records of others reveal no identifiable dwellings. It is quite possible that an earlier generation of cave houses did lie along the foot of the cliffs, and no longer survive. With the exposed cliffs of sandstone weathering and disintegrating over the centuries; a sensible way to maintain a safe site is to periodically demolish old unsound caves, cut the cliff back to a new solid line, and then excavate another generation of caves into the newly exposed rock.

In the same cliff, the caves of Shire Hall include slightly different “residential” caves, in that some were used as punishment cells. More dungeons lay beneath the old Town Hall at Weekday Cross but were destroyed by the railway’s arrival in 1894. Both sets of caves were recorded in penal use over 200 years ago.

Paupers lived in various caves alongside the main roads out of Nottingham. Mansfield Road (up to the top of the Forest), Derby Road (up to Canning Circus) and Hollow Stone (eastwards out of the Lace Market) all originally lay in valleys fringed with low sandstone scars; some rock faces survive along Hollow Stone, but they are lost behind buildings and raised road levels along

most of the other two. Records describe people living in caves alongside all three roads at various times from the 1300s up till about 1900. The town records of 1335 and 1595 refer to rock houses and “todeholes”, which may have been leper colonies, in the caves along Mansfield Road; some of these old dwelling caves may partly survive in the rooms immediately north of the mine entrance in what later became Rouse’s sand mine. Any cave houses along Derby Road would have been destroyed in 1740 when the old hollow way, the sunken road, was filled in by degrading the slopes and rocks along its sides.

Hollow Stone was originally the main route into town from the south, as it turned up from the road across the Trent and Leen bridges. It occupied a narrow ravine between sandstone scars that long had caves cut in them. One cave on the south side was used as a guard house in 1538, and also had internal steps up to the cliff top above. Squatters were ejected from the caves in 1607, before the entrances were sealed up, though some caves in the same road were rented to the poor in 1611. Many or all of these caves must have been destroyed when Hollow Stone was widened in 1740, and it is a new generation of caves that were bricked up in 1975, again to discourage vagrants. To this day, almost any cave that is left open and accessible is used by the city tramps for occasional sleeping and heavy drinking - though this can barely be called “living” in the caves.

Daylight shines through the windows and doorway of a cave, which was probably a summer house, cut into the low sandstone cliff across the lower end of The Park.

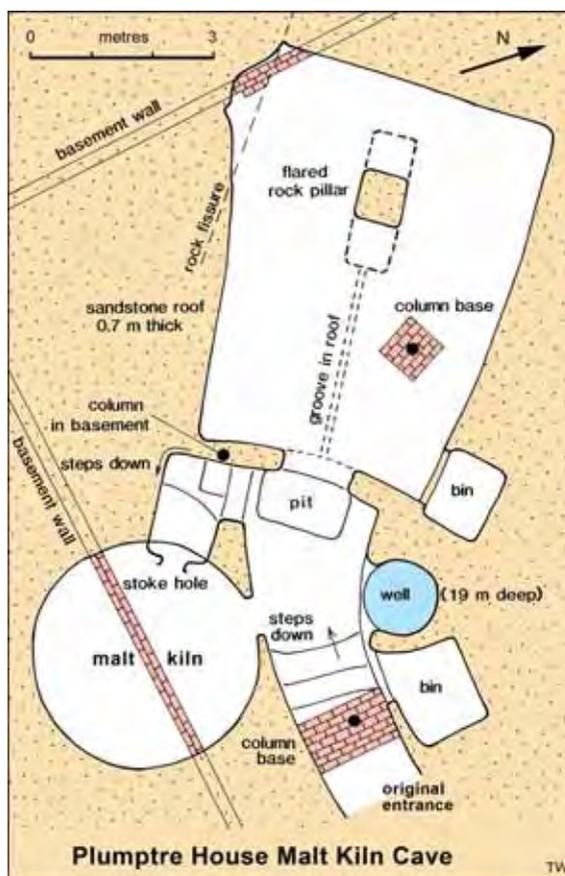


Malt kiln caves

Distinctive among the older of Nottingham's caves are the small complexes that included malt kilns. Entirely cut in the sandstone, each kiln was a roughly spherical cave room, whose dimensions varied from one site to another. The Castle Gate kiln cave is 4 m in diameter and 3 m high, while the Black's Head kiln is only 3 m wide but reaches 4 m high. Midway up the rock walls of each kiln is either a continuous ledge or a series of notches; either of these could support timbers to create a roasting platform. Beneath this, a charcoal fire was set in the deep central pit, which could be reached through a stoke hole entry at its level. A second upper entry gave access to the grain which was being roasted on the platform at ledge or notch level.

Each cluster of caves that formed a malting had a small central entrance room, commonly with various pits and ledges for storage. From it, steps led up to daylight. Opposite, there is generally a small cross carved in the sandstone over the doorway into the germination room. This was the largest cave room, and all known sites have a central pillar that bear some degree of carved ornamentation. Also off from the entrance room, on one side there is the kiln loading door, and beside it a few steps leading down to the kiln's stoke hole. Opposite the kiln, a well is deep enough to reach the water table, not far above the level of the Trent.

All these features are seen in the best of the surviving malt kiln caves, beneath the site of the old Plumptre House in the Lace Market, and beneath an office building on Castle Gate. To date, 28 malt kiln caves have been found in Nottingham, but all have been damaged to some extent. Later brickwork has been placed through the kilns of both the Plumptre House site and the Bromley House site on Angel Row. The kiln itself is still intact in the Castle Gate site, but concrete columns now breach the adjacent germination room, which is also now flooded knee-deep due to the rising water table under that part of town. The Castle Gate caves also contain a privy and cess pit, cut in the rock distressingly close to the well; ale produced at this site was probably rather stronger than intended.



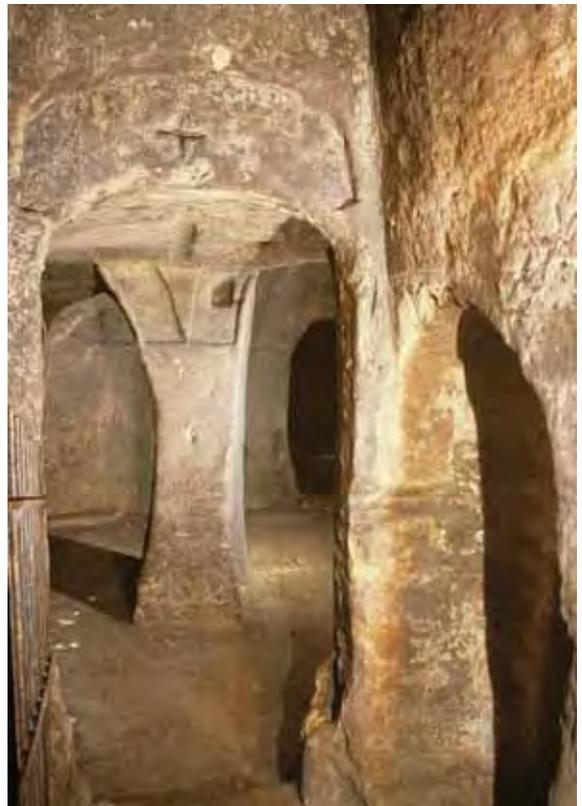
Plan view of the most complete of the malt kiln caves found beneath the site of Plumptre House late in 1991. The entrance room, between the well and the kiln, had been unroofed by the builders of the Victorian factory; they had also built a load-bearing brick wall through the middle of the malt kiln itself, and placed a brick column through the roof of the main germination room, which they thinned from its original thickness.

The malt kiln caves at Castle Gate and under the old Drury Hill have both yielded pottery from the 1200s, when malting activity was probably at its peak. Some of the cave malt kilns were disused by 1400, and most or even all of them had been abandoned by about 1640. The Adams' Brewery cave system, under the north side of Goose Gate, includes a large room that cuts right through the floor of an older malt kiln cave, so that now only the roof and part of the perimeter ledge survive, though the adjacent entrance room and its well have been cleared of their debris fill; the large germination room has survived in a slightly



The splendidly preserved malt kiln cave within the cave complex under Castle Gate. The view is in through the loading door, towards the person sitting on the wide ledge that supported the beams of the roasting platform; the stoke hole to the central fire pit is just visible on the left.

The view down the entrance steps into the malt kiln caves that lie just north of Middle Pavement. The malt kiln lies though the shadowed doorway on the right, while the well is behind the iron railings on the left. The germination room lies straight ahead, with its characteristic central column; both the cross over the doorway and the groove in the roof beyond are typical features of these cave maltings.



modified and extended form, as the northern arm of the brewery cellars (see map on page 28). Also half removed where later caves had cut into it, a malt kiln found on Huntingdon Street in 1995 is the only one that lies outside the old town limits; its discovery lends support to a thriving early village in the St Ann's valley, which could have been Whiston until it was destroyed in about 1330.

Public house cellar caves

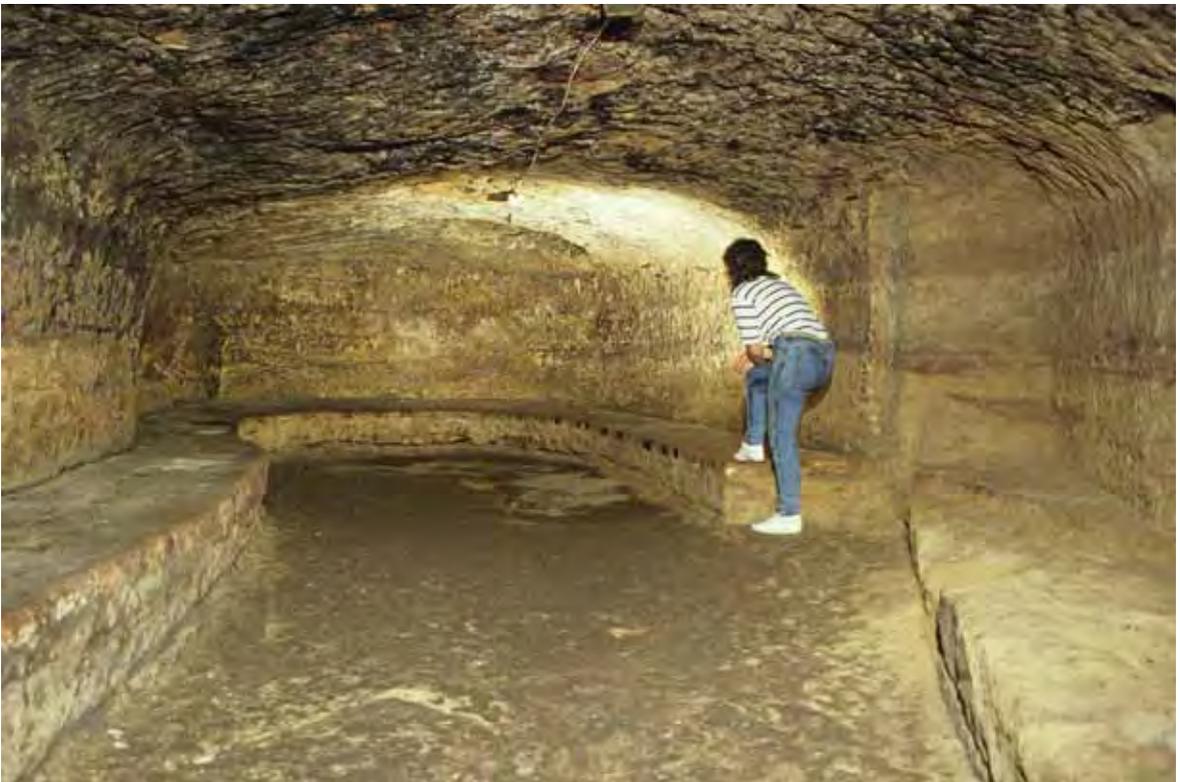
Constant temperature (about 14°C, or 57°F) in the sandstone caves made them ideal for the storage of ale, and many were cut beneath inns and public houses. Indeed, beer cellars are almost essential for an inn, and the shallow rockhead across much of Nottingham generally made it easier to dig cave cellars than to construct more conventional basements. Some of the inn caves were used for drinking, and travellers of the 17th century recorded Nottingham's fame for its good ale which was available for drinking in cave cellars.

The pub cellar caves have a characteristic form. Most are 3-4 m wide and perhaps twice as long, commonly with one rounded end, especially in those excavated later than about 1600. They are mostly just deep enough to leave about two metres of solid rock over their roofs, though some are deeper for no known reason. Especially among those made after about 1700, the cellar caves are distinguished by their perimeter thralls; these are low ledges cut in the rock, though

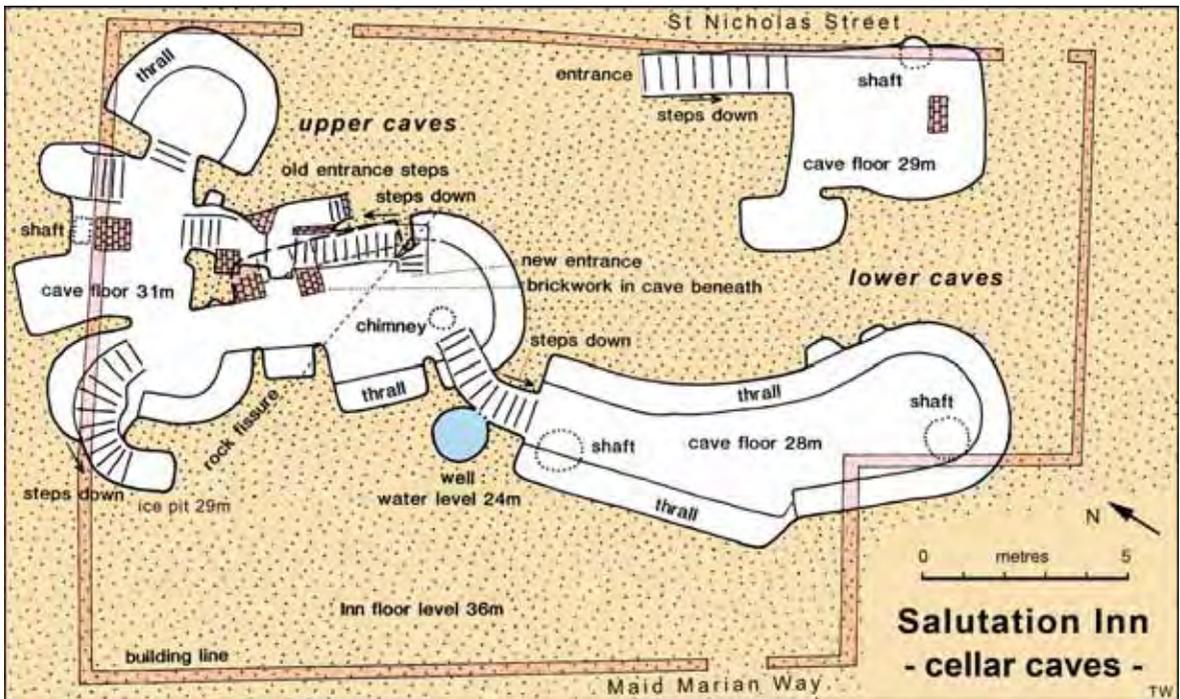
commonly rebuilt in brick where the rock was too much abraded after years of use. The thralls kept the barrels up off the floor, so that the ale could easily be drawn. Despite a common myth, they were not beds within cave houses. It was recorded in 1772 that a grand cock-fight was held in the Lion Hotel on Clumber Street, and it was probably held in the large cave cellar. However, claims that various small round caves were used as cock-pits remain open to doubt, as the rock ledges around the central pits were probably just barrel thralls against the walls. Many cellar caves also have a shaft for a barrel hoist cut through their rock roof.

The Salutation Inn, now facing onto Maid Marion Way, has an unusually large set of cellar caves that show four separate stages of excavation; stages are recognisable where older thralls were cut through to reach newer caves. The oldest caves form the group of three small

The lower cellar cave in the fine group beneath the Salutation Inn, which are very well preserved and are sometimes accessible to interested pub customers.



SANDSTONE CAVES OF NOTTINGHAM



Caves under the Salutation Inn on Maid Marian Way. The different levels are indicated by the approximate floor altitudes. There is believed to be another cave, currently inaccessible, beneath the frontage on St Nicholas Street between the two mapped caves.

rooms across the north end of the site, at the foot of the entrance steps. A second stage of this upper level added one longer room off to the south. Both these stages of the caves pre-date the existing building whose foundations blocked the original steps and necessitated a new flight of entrance steps directly above the second stage cave. Steps down to a blind end in the northwest corner may have reached into a cold air trap used for storing ice or supplies. A third stage lower level was reached further to the south, and this had a fourth stage extension that introduced the bend in the lower cave, probably to keep it largely beneath the site boundary.

The large complex of cellar caves beneath the Old Angel Inn in the Lace Market occupy two levels, almost certainly of different ages; there are eight cave rooms reached by three shafts and a shared stairway, and some unknown continuations are bricked up. In contrast to the Salutation and Angel, many of the city pubs had only one or two cave cellars each, such as beneath the old Roebuck and Yorker Inns, either side of the old Nottingham Brewery caves on Mansfield Road. Many of the old pub cellar caves are now abandoned, and many no longer

have a pub above them, but the Bell Inn, Trip to Jerusalem, Cock and Hoop, Golden Fleece and Loggerheads Inn are among those which still keep the beers in cave cellars.

Most of the pub cellar caves are probably post-medieval, but their consistency of style makes them difficult to date. A cellar cave below Malin Hill has 1733 carved neatly into its wall above the barrel thrall, and is one of a number of date-stamped cave cellars under the city. Some unmarked caves may be much older than this. The caves behind the Trip to Jerusalem Inn, below Castle Rock, have many claims to antiquity thrust upon them, but both the Inn and the caves date only from the early 1600s. Older caves could have existed in the foot of Castle Rock but would have been totally destroyed around 1600 when the cliff was cut back to its present dimensions. Around 1875, the last of Nottingham's pub caves were cut in the St Ann's area. Recent plans to excavate a new cellar cave,

SANDSTONE CAVES OF NOTTINGHAM

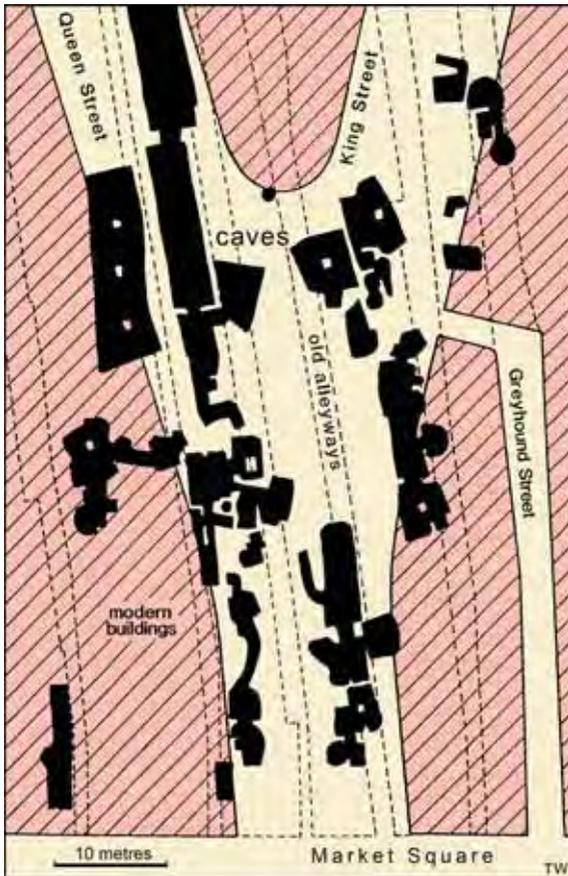
as an extension to one already in place beneath the Lion Inn in Basford, were put on indefinite hold because of the cost involved; modern safety regulations make cave digging rather more difficult than in the past.

In the centre of Nottingham, the number of pub cellar caves almost matches the number of pubs, when that includes those that no longer survive. There used to be pubs in profusion - one for every seventeen houses in the old town in 1740. Licensed premises between 1758 and 1764 numbered 140 within the town limits, though some of these may not have been inns. Cave cellars are now known from many of these, but there are many sites where no caves are known;

Some of the caves beneath the north side of the Market Square, with their pattern clearly related to the old closely spaced alleyways, of which just part of Greyhound Street survives today. These caves were all filled during redevelopment just before 1900.



One of the two smaller wine cellar caves under the garden of Willoughby House, where a central column and table were carved from the bedrock sandstone.



yet more beer cellar caves are known where there is no associated pub from that era. Small taverns were particularly thick on the ground in the notorious slums of the nineteenth century between Long Row and Parliament Street. Most of this zone has long been redeveloped, but the distribution of the caves follows the line of the old alleyways that led north from the Market Square; this is best appreciated in the Queen Street area, though the caves are now full of concrete. The sand and rock rubble dug from this multitude of caves appears to have been easily swallowed up by early street repairs and landfill.

A variation on the cellar cave was the cave bar. These are well known in the Trip to Jerusalem where they extend back into the sandstone behind the building facade, and the main bar in the Hand and Heart on Derby Road also reaches back into its own cave.

Older caves and undercrofts

Most of Nottingham's caves were cut to provide dry, safe and convenient storage rooms beneath buildings in the crowded old town where space was at a premium; and many were for storing products other than ale. The older storage caves are largely within the site of the old town, and consist of either single caves or small groups of caves reached by stairways cut in the rock from the buildings above.

Many caves were just beneath private houses. The splendid Georgian house at 17 Castle Gate was built in 1740-50 with two cave cellars that were probably designed as wine stores; the larger cave partly under number 19 appears to be a later addition, perhaps from when that house was built in 1775, and the link between the caves was probably cut even later. Much larger are the two caves that were cut beneath Plumtre House when it was rebuilt next to St Mary's Church in 1724. There are two caves, at different levels, each 5 m wide with a gently arched roof that is over 2 m high; one cave is 8 m long, and the other

reaches to 11 m. They were splendid cellar caves, but they were lost when the house was demolished and Birkin's factory was built over them in 1855. New foundations cut through the entrance to the caves, and new stairs were probably excavated into each cave at that time, but these too were subsequently blocked and forgotten. The caves were found again during redevelopment in 1988.

Finest of all the private cellar caves is the group beneath the garden of Willoughby House on Low Pavement. Cut when the house was built in 1738-41, there are three circular caves, each with an elegant central column with a table cut in the rock. The largest cave, 7.6 m in diameter also has a perimeter thrall – or seats, and it is possible that this was designed as a venue for a novel underground drink, while the two smaller caves were purely for storage within their brick wine bins. A flight of steps descends from the House

The fine columns and roof arches in the medieval undercroft cave that lies beneath the old Pearson Brothers department store.



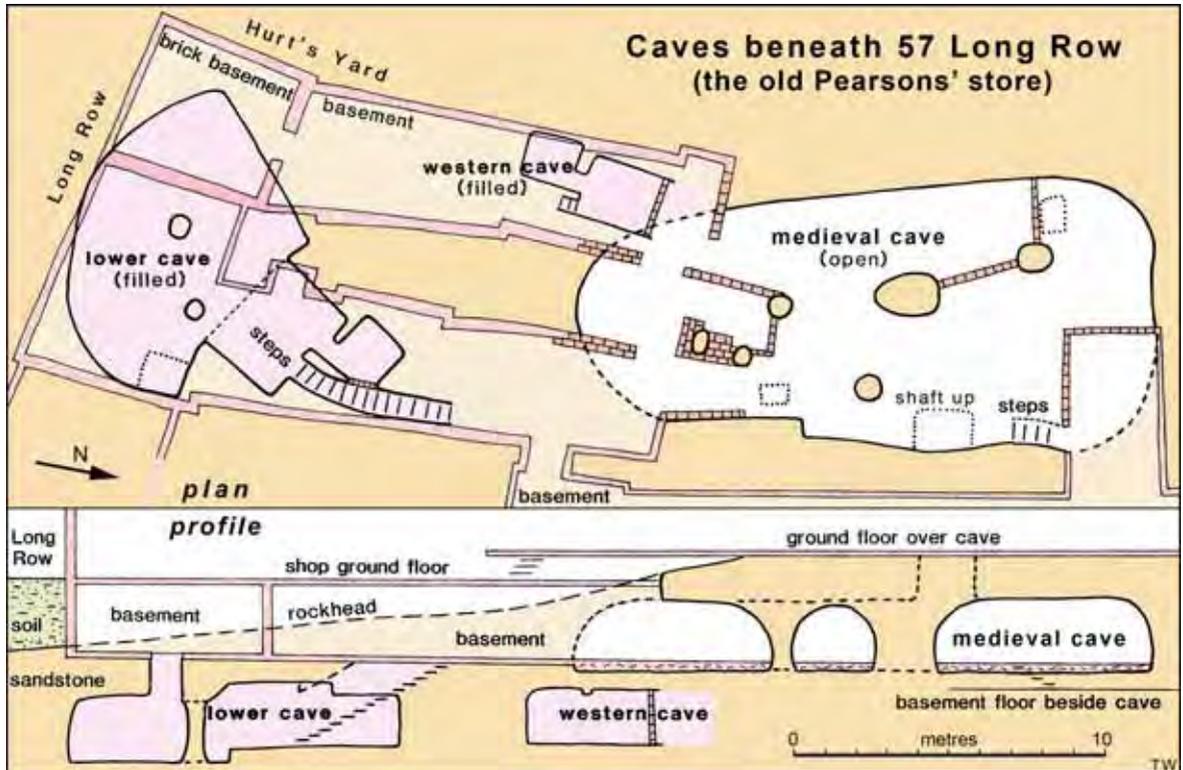
SANDSTONE CAVES OF NOTTINGHAM

garden, but a second entrance was excavated in from the cliff face to the south, as its emergency exit during the Second World War.

Away from the private houses, various materials were stored in the caves. Wool was kept in some of the caves beneath the old Vault Hall, on Drury Hill, and perhaps also beneath Shire Hall, before it was shipped out on the Trent barges. Some caves were even used as bank vaults. Others appear to have been ice houses, used for making ice from packed snow that created its own microclimate in the cold air trap provided by a deep cave; there was a large ice house in the caves west of Bridlesmith Gate. Another ice house, in Castle Rock, was used by a town confectioner in the late 1700s, after it was adapted from the old malt kiln cave; steps up the outside of the rock to an entrance perhaps date from this time.

The larger medieval caves, or undercrofts, were probably used for storing a variety of merchandise, and a series of them underlay the old buildings of Long Row on the northern side of the Market Square. Perhaps the finest that survives is under the site of the old Pearson Brothers department store, now occupied by Habitat and Boots. A single cave 18 m by 8 m has six flared rock columns of various sizes, some with ornamental detail carved into the sandstone. From these, the rock roof is sprung in a series of broad three-dimensional arches, each different from the others. The original entrance is at the southern end, nearest to the sloping ground surface and closer to Long Row, but this is obscured by brickwork that is probably of Tudor age. The southern end has also been damaged by brick basements that were set into the rock with built roofs in the 1700s. Beneath these, another lower cave lies close to the Long Row frontage, but it lacks the elegant roof arching, and is probably much younger than its medieval neighbour on the higher level; it was filled with concrete in 1990, when it was found to have a thin roof under rather too much load.

Plan and profile of the caves beneath the old Pearsons' department store on Long Row. Some brickwork has been omitted for clarity; the lower cave and the western cave are both now full of concrete, but the large medieval cave remains intact.



Wells and cistern caves

Featured within many caves are the wells that reach down through them or from them. The sandstone is a good aquifer, with a water table that slopes gently down to the Trent floodplain, so that it is just below the cave floors in the Drury Hill area but is at much greater depth further north in the town. Some wells were needed where water was required in the caves, while others passed through the caves to yield supplies for the houses above. Most have niches in their walls to provide foot and hand holds or to hold timbers that allowed the well-diggers to climb up and down, but there is no evidence that any of these vertical shafts were for access to the caves.

There are at least two known caves that are totally flooded, and it appears that they were excavated purely as underground cisterns. The sandstone is so permeable that any well or cave sunk below the water table steadily fills with seepage water. So caves were not cut below houses on the floodplain south of Broad Marsh, where the

water table is just a metre or so below ground level. But the same sites could provide capacious cisterns where large amounts of water were needed at irregular times between periods of slow recharge. Like all Nottingham's caves, these were dug by men using only hand tools, and this would have been impossible underwater; but they lie only just below the water table, where very basic pumping could keep the excavations dry enough for the digging teams to work. Then the cisterns were allowed to fill to provide water storage, as long as the rate of pumped extraction was kept less than that of natural inflow through the permeable sandstone.

Of the two known caves that are thought to be old cisterns, one is near the western end of Castle Boulevard, and the other lies under Bellward Gate, east of the Lace Market. A small boat was launched on the lake in the latter cave, to find its extent before a road was built over it in the 1960s,

The largest of the Western Caves inside the cliff face under the old Drury Hill. The cave may be as old as the medieval Pillar Cave nearby, but was modified with a brick floor for use as stables in the late 1700s.



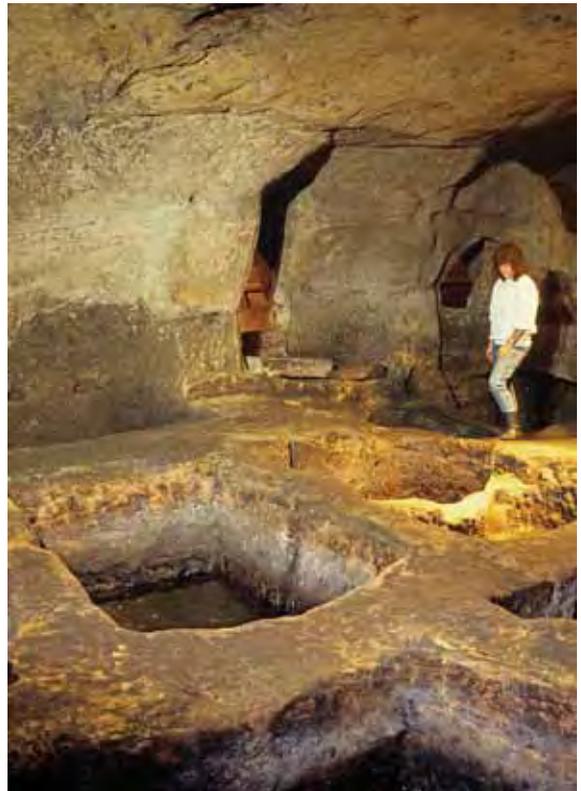
but the records of this venture have been lost. Both cistern caves are now flooded to above roof level; shafts lead down into them, and divers have found extensive chambers from them, but neither has yet been fully investigated and recorded. The three shafts into the Castle Boulevard cave are all now blocked or capped.

Beneath the site of the old General Hospital, just north of the Castle, a series of long caves includes a main tunnel that is nearly 100 m long. Most of these tunnels are only high enough for stooped walking, though they are of comfortable width. There are trenches cut in parts of their rock floors, and they contain some sections of old iron pipes. These caves appear to have been part of an underground water system, which was supplied from a reservoir built around the year 1730 on land where The Ropewalk now meets Park Row. Conceivably, the caves are older than the reservoir, and were merely utilised for some later water lines, but their continuous gentle gradients suggest that they were designed to carry flowing water as part of the town's supply.

The caves below Wollaton Hall, west of Nottingham, were cut mainly for the storage of wine, ale and perhaps water; some date back to when the Hall was built in 1588. They lie across the boundary of the Nottingham Castle and Lenton Sandstones. One cave room now has standing water in it, and is known as the Admiral's Bath; it originally had a horizontal entrance from the slope in front (north) of the Hall, but this was blocked and buried by landscaping long ago. Probably only since then has water been ponded in the cave, partly supported there by the lower permeability of its Lenton Sandstone floor or perhaps by some artificial clay puddling. Closer to the Hall, there is sometimes a very small water flow from the sandstone in the caves, but it is unlikely that the cave was ever a significant water supply for the Hall. The Admiral's Bath cave probably originated as a garden folly, with the brick-lined cellars only linking it to the cave beneath the Hall at a later date.

Some caves at the lower end of the city centre, around Broad Marsh, also now have standing water in them - because they reach below the modern water table. As the cave floors must have been dry originally, the water table appears to

have risen by about a metre since medieval times. This is probably in response to landfill operations that raised ground levels on the adjacent part of the floodplain in order to create better sites for houses. New drainage channels on the raised ground became the natural outlet for groundwater from the sandstone, so the water table was raised under the entire town centre, and some of the cave floors were submerged. Then, within the 19th century, excessive abstraction from wells supplying the town's expanding industry caused a major but temporary decline of the water table; under these conditions many of the flooded caves became dry again, and a boat could be launched on the lowered water surface in the Bellward Gate cistern. Since then, industry's demands for water have reduced, so that well pumping has decreased; the water table has therefore risen within the last 20 years to re-flood some of the lower caves.



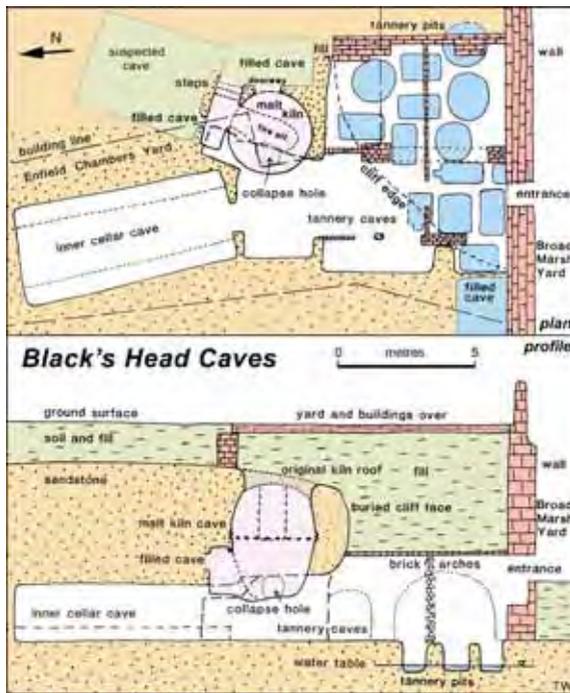
Vats cut into the sandstone floor of the Tannery Cave, which originally opened into the cliff face at the edge of Broad Marsh.

Tannery caves

Besides their use for storage, some caves were suitable for manufacturing, especially where fluids had to be kept at constant temperature - as in the case of storing beer. In the 15th to 17th centuries, there were dozens of tanneries in the Narrow Marsh area, below the bluffs along the south edge of town; together they created an environment so foul that supposedly even the rats kept away - with the benefit that it stayed clear of the plague. Each tannery needed to have a series of vats to hold the different solutions required for tanning animal skins; many of these were cut in the sandstone of the site floor. Building a tannery into a cave had the obvious advantage of more stable temperature conditions, and tanning vats have now been found in four of the caves cut into the cliff face behind the floodplain marsh; these are the only underground tanneries known in Britain.

One tannery occupied two of the Drury Hill caves, now preserved beneath the Broad Marsh Centre. Over 5 m wide and twice as long, the Tannery Cave has a dozen rectangular vats cut a metre deep into its rock floor. The adjacent Pillar Cave is a little wider and has a single central pillar to support its roof; it was another tannery cave, but its vats were built up in brick and clay, instead of being cut into the rock, and just three survive today. The tanneries were in use at least up until 1639, and a cess pit in the floor of the Pillar Cave has yielded pottery dated to 1270-1300. Both these caves once opened to daylight at the foot of the sandstone cliff, though some form of wooden buildings probably then stood across the entrances. The caves were modified through the centuries, and an original entrance room into the Pillar Cave had collapsed before about 1400.

A third cave tannery was found in 1992, at the Black's Head site just 80 m west along the cliff line from Drury Hill. A wide cave set into the cliff face had at least 14 square or round pits cut into its rock floor. What proportion of these tannery pits were underground, and how many more there were, are unknown; the cliff and cave roof have been cut back over the centuries, but it is likely that the tannery was originally well inside a cave with a large front opening similar to that at the Pillar Cave, just along the cliff. The vats were later filled with earth, and the front of the caves was replaced with brick arches, when beer cellar caves were cut further into the rock for the predecessor of the Black's Head public house, which faced onto the old street of Broad Marsh. In 1992, impending failure of the brick arches threatened the buildings above, and the vats were re-excavated and then filled with concrete during essential remedial works. A malt kiln cave just a few metres from the tannery cave was a completely separate cave as it was entered by steps from land above the cliff.



Plan and profile of the caves at the Black's Head site, west of Drury Hill. The malt kiln cave and the tannery pits were excavated during remedial building works in 1992, and were then backfilled with concrete. The other cave rooms of the malting complex were not excavated, though entry doorways to them were seen.

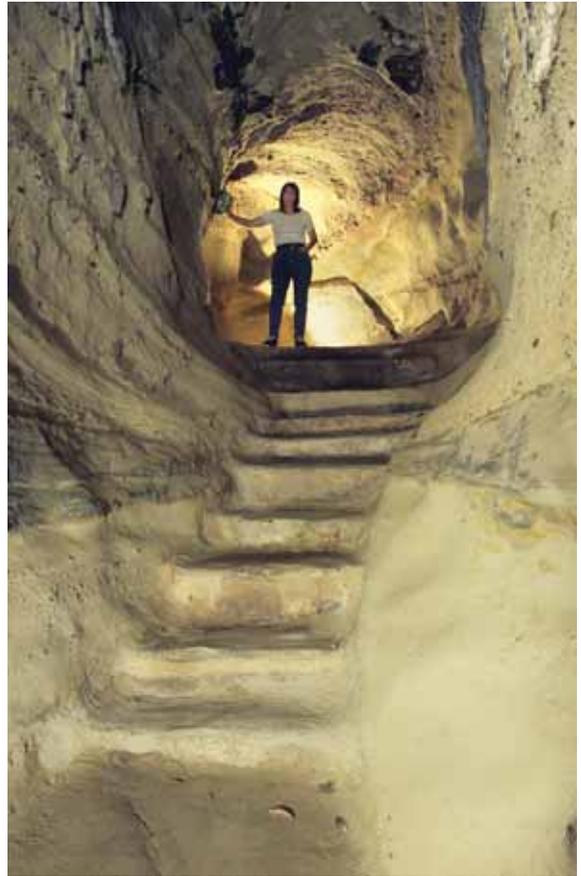
Tanneries were very much a feature of the Broad Marsh area up until about 1700, and it was no surprise when part of another tannery cave was found recently, in between the earlier ones; it still awaits complete excavation to reveal the number, extent and details of the pits cut into its sandstone floor.

Cave tunnels

The myths concerning long cave tunnels beneath Nottingham far outweigh the reality, but a number of caves in Castle Rock do have dimensions and proportions which mean that their prime purpose was underground access. Certainly some of the Castle caves are medieval, and the oldest is probably Mortimer's Hole, linking the castle atop the Rock with Brewhouse Yard at the foot. It was probably excavated in about 1194 as a strategic route for the military where there is no easy surface route off the south end of the Rock. Later, the cave created convenient access, with steps for the 35 m descent to the yard, where ale was brewed and corn was milled to supply the Castle. For its whole length the cave is only close in behind the cliff face, and the middle section was unroofed in 1643 to create a cannon emplacement part way up the cliff in the Civil War. The rather tenuous connection with Roger Mortimer, paramour to the dowager Queen Isabella, dates from his arrest at the Castle in 1330. To make the surprise arrest, soldiers of Edward III, did enter the castle through a cave - though Davey Scot's Hole better fits the description of the royal arrest. This provides a cave route out of the Castle to the northwest, and was recently re-discovered with its upper end buried under the castle's outer walls and its lower end hidden beneath paving in a modern garden.

Beneath the western ramparts of the Castle, the Rock Chambers were the Castle's cellar caves and dungeons, though any link to the imprisonment of King David of Scotland is rather doubtful. Lower down, a malt kiln cave is cut by various later passages entered from the land below. In 1955 these were linked to the Rock Chambers by a short new tunnel, in order to create a convenient circular route for the modern cave tours.

Very different from the man-sized tunnels of the Castle caves, the Park Tunnel is a massive 8 m high and wide. Dead straight for its 75 m length, it was opened in 1855 to provide direct access from the Park Estate to Derby Road. Designed to permit coach-and-fours to pass inside, it was sadly made redundant before its completion by the construction of easier roads elsewhere into the Park. It is now tucked almost out of sight

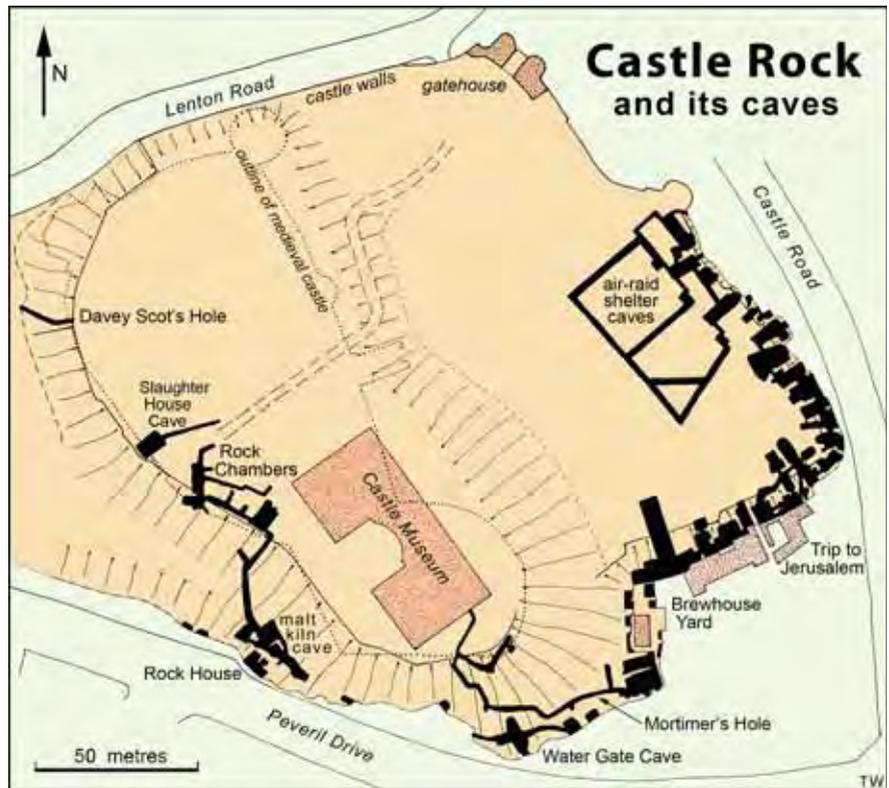


Steps cut into the sandstone floor trace the long descent of Mortimer's Hole, which was excavated just inside the cliff face from the top of Castle Rock down to Brewhouse Yard.

behind walls and buildings, and is nearly blocked at the Derby Road end, but it is still open as a footpath through to Tunnel Road in the Park. It is best reached by the spectacular descent down the steps from Upper College Street. An older, smaller, parallel tunnel is now inaccessible, with one entrance high in the cliff above the Park Tunnel's southern entrance, and the other end blocked by masonry. The origins of this smaller cave tunnel are unknown. It may be compared with another that passes beneath Newcastle Terrace 200 m to the northwest. This one is also of pedestrian size, just 25 m long, and appears to have linked a house on Derby Road with its garden lower down the slope, though it is now bricked up at both ends.

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The various caves under Nottingham Castle Rock. Mortimer's Hole descends from top to foot of the cliff, as does Western Passage with its recently cut link into the Rock Chambers. In Brewhouse Yard, caves include very old brewing chambers, and also the pub cellars of the Trip to Jerusalem and the Gate Hangs Well (just east of the Trip). The smaller caves along Castle Road post-date the medieval walls, and the air raid shelter caves were cut in the Second World War. The medieval castle atop the rock was demolished in 1651; the Castle Museum occupies the mansion built in 1679 and restored in 1878.



The exit from Park Tunnel.



Carved and ornamental caves

Decorative carving of the sandstone adorns a number of the medieval caves in Nottingham. Bas-relief heads, some on shields, are depicted on many old drawings of the caves, and one survives carved near the top of a column in a cave under a shop on Long Row. Sadly most of the others have been lost or destroyed, though carved crosses survive on the walls of the Goose Gate caves. Some of the sandstone columns within the larger cave rooms are also carved with ribs and shoulders; in the older cave beneath the old Pearsons' store at 57 Long Row one column is round beneath a carved square capital, and the carving of the pillars in the Willoughby House caves is even more ornate.

A group of caves in The Park contain ornamentation and carvings on a scale far surpassing any other in Nottingham. Alderman Thomas Herbert was an affluent Victorian lace manufacturer who had a large house on the Ropewalk (since extended and converted into offices). Most of his back garden was on the far

side of Park Terrace, falling away down the steep slope into the Park Valley, and he had a fantastic series of caves cut beneath its terraces. Their decorative nature places them as follies, in the grand Victorian tradition; a mason named Jennison was probably involved in their carving, and the work dates from around 1840.

Each main cave originally had a staircase entry at the rear, with a tunnel leading beneath Park Terrace, and then opened out horizontally onto the next terrace down the garden. Columns Cave is at the highest level, with a single room 13 m long and 7 m wide. Its roof was supported by 18 columns, each square cut, with ornate capitals and etched panels; half pillars are carved in the walls with bas-relief figures and crucifixes cut into the rock between. A rear extension of the cave had brick columns and brick roof arches

The statue of Daniel in the Lions' Den carved in 1856 in the bedrock sandstone of the magnificent cave in Thomas Herbert's garden. This photograph was taken in 2006, long after some of the lions' limbs and part of Daniel's head were lost to vandals. The colour bands across the statues are a natural feature of the rock.



SANDSTONE CAVES OF NOTTINGHAM

when it was filled with concrete in 1976 to stabilise the carpark above. Fortunately, the main sandstone cave survives beneath the roadway of Park Terrace with 17 rock columns and just one brick replacement.

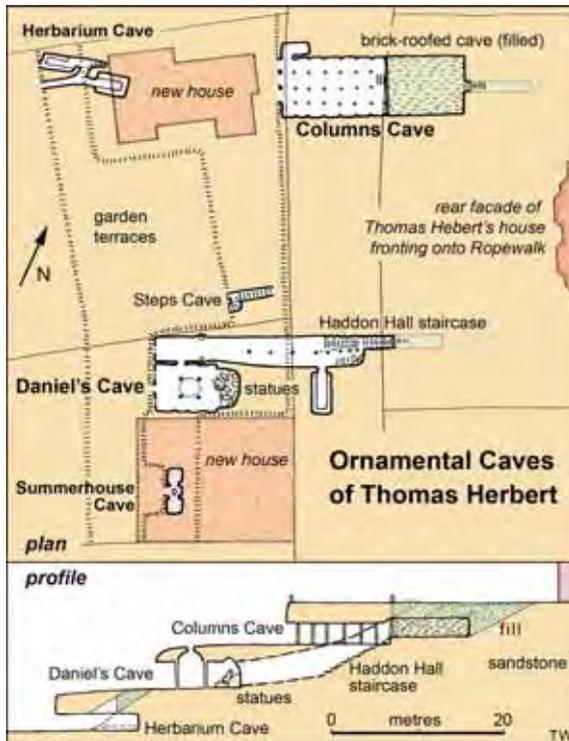
One terrace lower down the garden, Daniel's Cave is the most spectacular of all. A cave 10 m by 6 m, has a doorway and widow openings to the garden, and contains four central columns around a carved and ribbed roof dome that rises to a skylight. Carved into the sandstone forming its rear wall is the spectacular image of Daniel in the Lion's Den. Close to life size, Daniel and six lions are carved with three-dimensional detail entirely in the bedrock sandstone without any added masonry. The whole scene, about 3 m high and 4 m wide, is a work of art destined never to be moved. In the same cave, the date 1856 and the initials T H were carved on the rock wall, but are no longer readable. From the side of Daniel's Cave, a

spacious passageway leads back into the rock and then up a pillared staircase with balustrades carved in the sandstone to exactly copy a staircase in Haddon Hall in Derbyshire (*see* page 5). Niches and columns contain various statues and a wealth of detail, all executed in the bedrock sandstone.

Adjacent to Daniel's Cave, the Summerhouse Cave is smaller and bears a date carving of 1872. It has a central font, and animal figures are carved in bas-relief and full relief on the walls and columns. Some of its wall recesses are adorned with blocks of tufa, which was probably imported from the Peak District. The whole effect verges on the grotesque. The lowest cave again has entrances on two levels, and its two small rooms have perimeter ledges which suggest it may once have been used as some form of herbarium.

In all the caves, many of the window openings were originally fitted with frames and stained glass, but little of these survive. Being open to the elements, the cave walls have been severely weathered over a century of exposure; many of the carvings and statues have lost their details, though the damage is notably less in the upper recesses of the Haddon Hall staircase. Close to an open doorway, the main Daniel carvings have been severely weathered in the past, and also suffered badly from vandalism when the caves were unprotected on wild land. Daniel and three of the lions have lost their heads, and a few lions' legs are missing too. Fortunately the caves are now gated and protected in the gardens of new houses along Park Terrace, while doors and shutters reduce the rate of weathering.

Across the southern edge of The Park, the low cliffs just north of Fish Pond Drive, contain a series of caves lying east of the remains of the Lenton Hermitage caves. These probably originated as garden houses, as they have doorways and widows cut from the rock, but one of the caves is also elaborately carved; two life size statues may be images of Samson and Moses, and there is a couch carved into the end wall. The style is very similar to that of Herbert's caves, and the carvings may date from about the same period, when the caves were related to either the bowling club on the land below, or to houses along Lenton Road above.

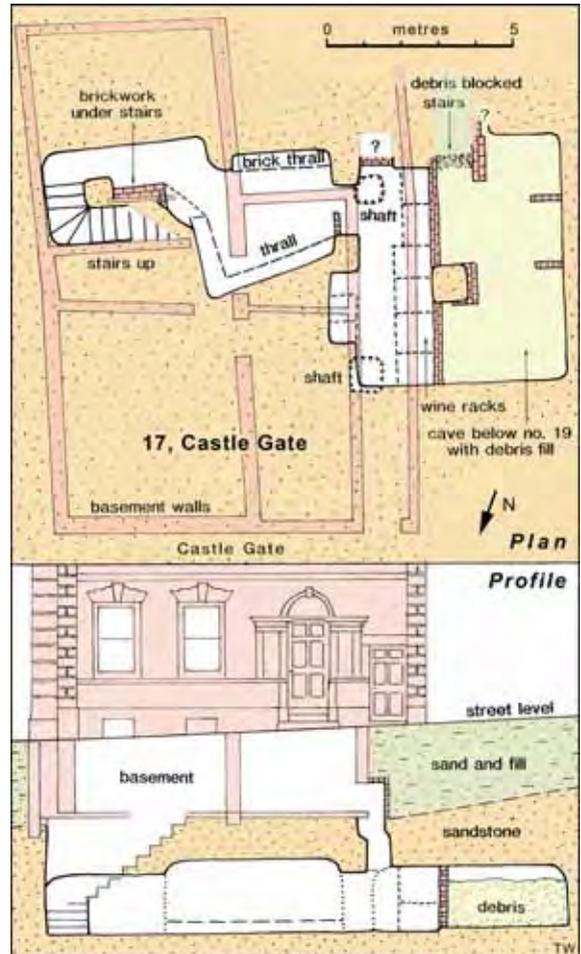


The caves that originally lay in Thomas Herbert's garden on the slope above The Park. The profile omits some caves for purposes of clarity and does not show the new houses below Park Terrace.

Later storage caves and vaults

Growth of Nottingham's industries, notably since about 1800, was matched by the needs for greater storage capacity, some of which was underground. The later caves tend to be larger than their predecessors, and many were characterised by systems of parallel rooms; they have more squarely cut corners, and lack the elegant flared pillars of some of the older caves. In 1791 the Adams' Brewery cut its system of caves beneath premises in the Lace Market district, and some of these spacious rooms were later used by a nineteenth century butcher though probably after they were unroofed and incorporated as shop basements. Close to the Adams' Brewery caves, Jalland's wine vaults occupied another series of large caves, also beneath the north side of Goose Gate.

In the Victorian era, redevelopment of buildings above ground was often made easier by unroofing the caves and cutting back their rock sides to accommodate load-bearing walls for the new, larger buildings; some of the Drury Hill caves were modified in this way. A variation in style was presented by the Hickling Laing wine vault caves alongside St James Street, cut just before 1800. The frontage building in Angel Row already had some small old caves beneath it, so the wine vaults went in even lower, with their floor 8 m below street level. A large shaft drops the full depth, and access steps twist down

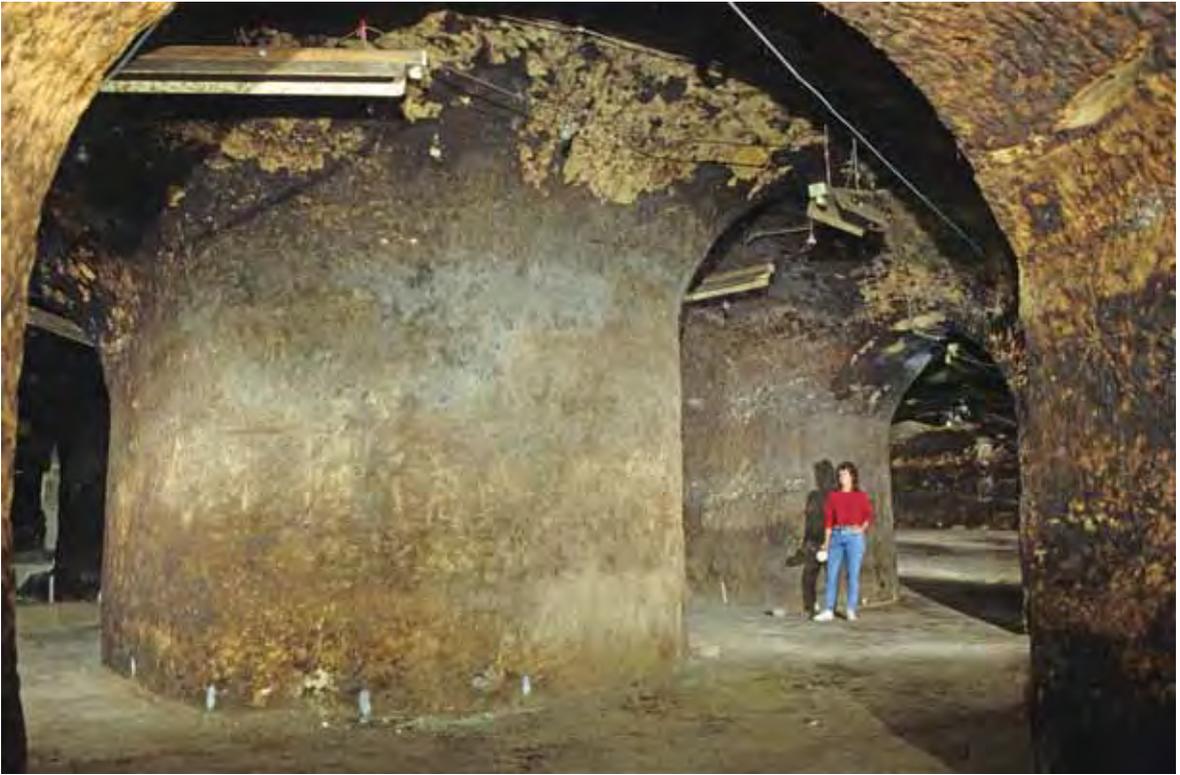


Plan and profile of the caves beneath 17 Castle Gate.

Large cellar caves under the old Shipstone's Brewery.

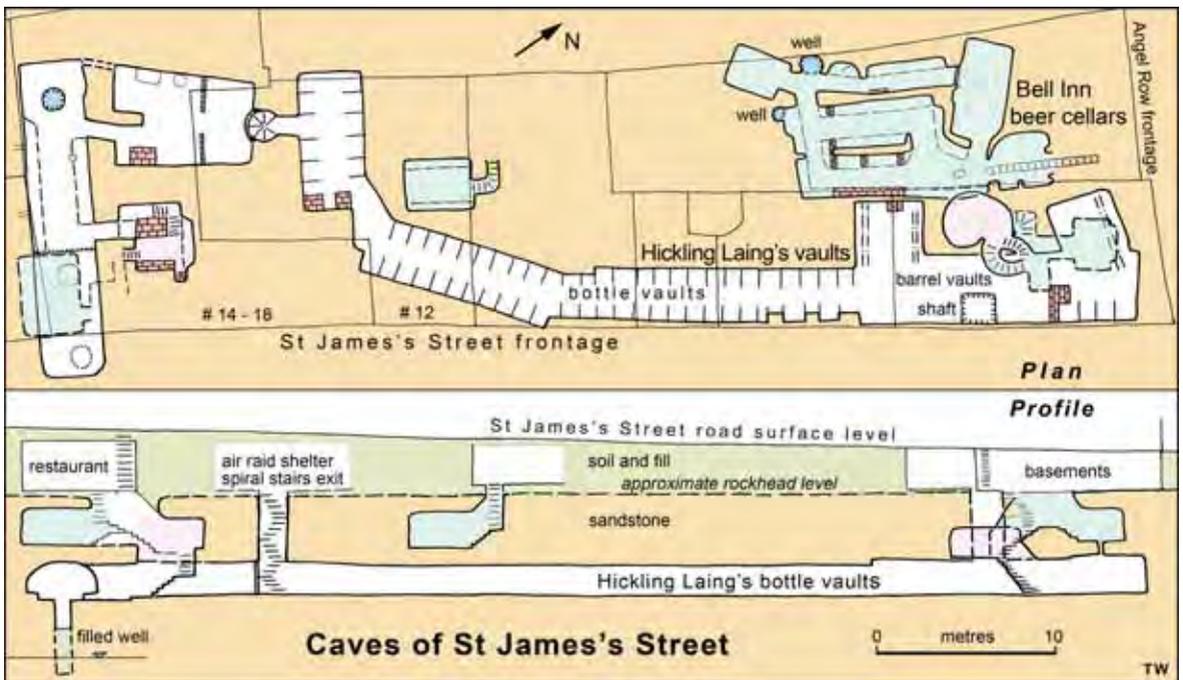


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Massive sandstone columns between the spacious caves that were excavated to become the cold store for Burton's, the Victorian purveyors of fine foods

The Hickling Laing wine vaults and adjacent caves that extend parallel to St James Street, together with the cellar caves under the Bell Inn (not on the profile)



SANDSTONE CAVES OF NOTTINGHAM

through the older caves. There are barrel rails across the larger cave rooms at the foot of the shaft, and wine racks, partly cut in the rock and partly built of brick, line both sides of the long vault reaching to the southwest.

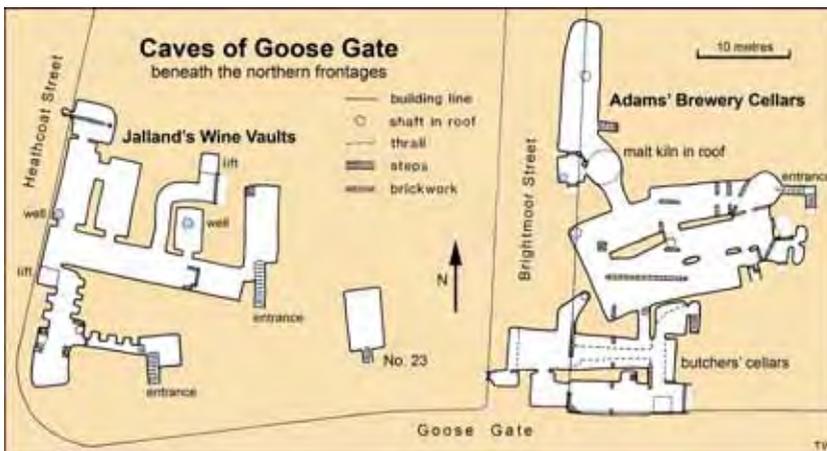
Nottingham's rapid expansion following the 1845 Enclosure Acts led to a small number of larger caves being cut beyond and north of the old town limits. Skinner and Rook's wine vaults now lie behind the Guildhall; they were cut in 1860, and enlarged a decade later, but were then heavily modified for the 1939 war. Around the same time, the Nottingham Brewery cut extensive caves beneath its site on Mansfield Road, now under York House. These were cut in various stages, and even broke through into the old cellars beneath an adjacent inn. An important addition was the tunnel that reached out into the old

Victoria Station built in 1894; this allowed the beer to be taken direct from the brewery cellars to rail wagons on its own siding in the station. Circular marks from the barrels can still be seen on the cave walls, though this exit is now sealed behind a later retaining wall in the railway cutting. Also north of the town centre, Burton's gas-refrigerated cold-store was cut in 1886 as large caves close to Talbot Street; they were in use for less than 100 years.

The sandstone reaches north into the Basford area, and a number of caves survive there. The largest were cut in 1852-1880 beneath Shipstone's Brewery on Radford Road. Nine caves each 50 m long and 5 m wide form an orderly parallel system with short cross links - in marked contrast to the irregular little rooms of the medieval caves beneath the old town.



Shelves cut into the sandstone walls of one of the group of storage caves that survives beneath Gawthorne House on Low Pavement. Though so many caves were mainly used for storage, these are the only rock-cut shelves now known..



The various caves under buildings along the northern side of Goose Gate, including the large group originally used as Jalland's wine vaults; the caves used as beer stores for Adams' Brewery include the northern arm that cut into and extended a much older malt kiln complex.

The sand mines

Within the city, the Nottingham Castle Sandstone is too weak to yield decent building stone, but it is so friable that it is easily excavated to produce loose sand. In historical times this was in demand, as building sand, and also for spreading on the floors of houses and public buildings to absorb the dirt, long before carpets were in use; some of the mined sand may also have been used in glass factories within the town. Cleaner sand could be obtained underground where the best beds could be followed without problems of land ownership, and two important groups of mines were established up the Mansfield Road.

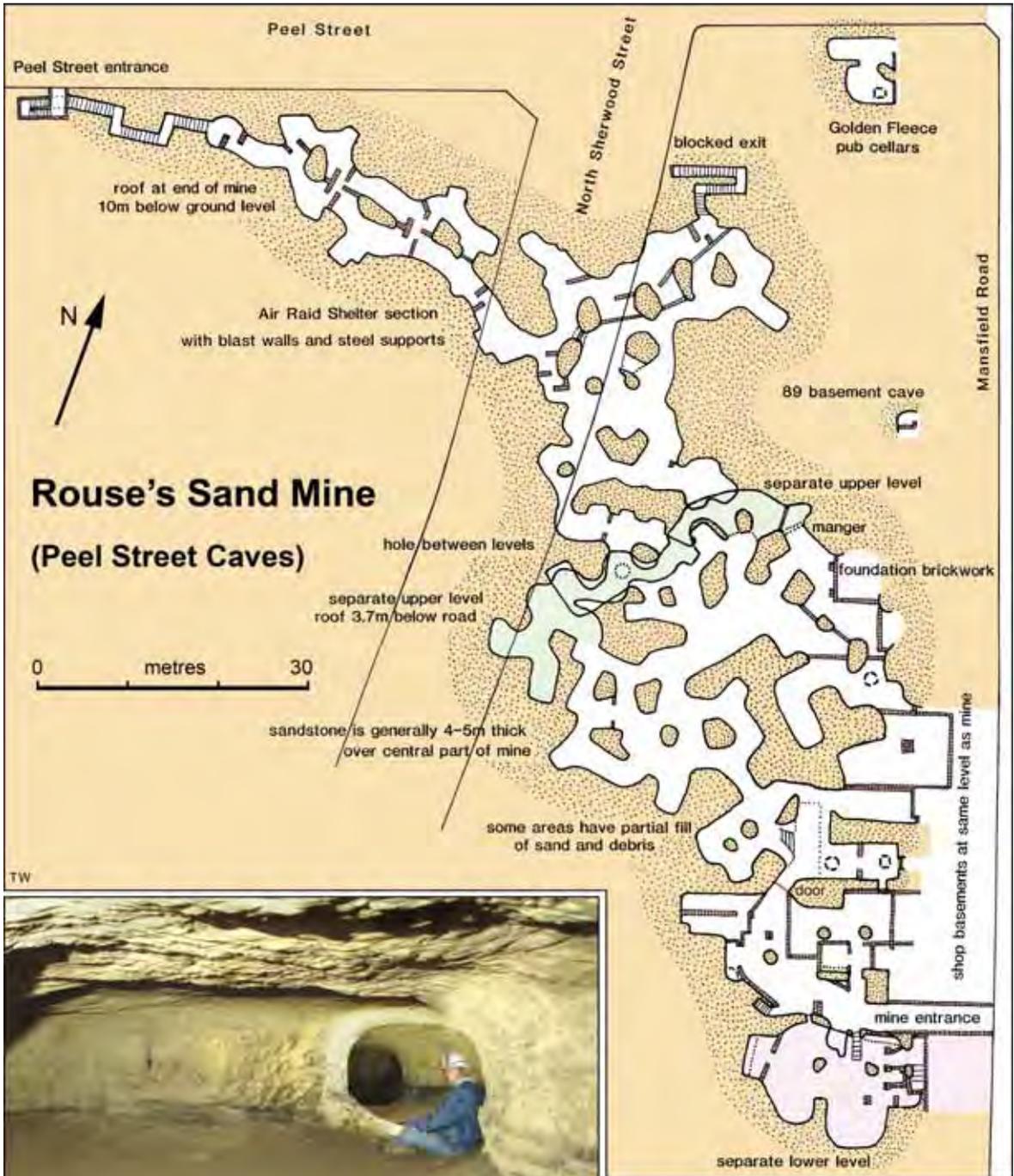
James Rouse worked a sand mine under the west side of Mansfield Road from about 1785 onwards. This was a typical, hand-worked, pillar-and-stall mine with unsystematic working achieving up to 80% extraction in some parts. Pillars are mostly rounded, and the mined out stalls are generally 2-3 m wide, but reach to 5 m across a few rooms. More than 700 m of mined galleries now form an underground maze. The working followed the bedding of the sandstone, almost horizontally. Some sections of the mine incorporate two levels, each a little less than 2 m

high; in a few places these are separate and superimposed, but mostly they have been coalesced to form the higher galleries that were worked in the two stages.

The mine yielded over 10,000 tons of sand. It was entered direct from Mansfield Road, and the nearly level drift access allowed the use of donkeys for hauling the sand underground; a trough cut in the rock may have been a manger for their feeding. The location of the mine was dictated by the quality of sand available close to the old town. It extended beneath the Sand Field, which was freeman's land - effectively a common - where surface diggings would not have been permitted. The section of the mine alongside Mansfield Road is complicated because it incorporates various cave rooms of different origins. Rouse appears to have worked his mine through some other caves, which may have been some older mine workings, but could also have included some early cave dwellings; remains of these are barely recognisable in some of the rooms close to the entrance. Some of these caves have rock thralls, where rooms were used as pub cellars after the demise of mining.

A gallery in Rouse's sand mine; the pillar-and-stall plan and the two levels of working are clearly visible.





Outline map of the pillar-and-stall mine worked for sand by James Rouse beneath land from Mansfield Road to Peel Street.

The hole between the two levels that remain within part of Rouse's sand mine.





The radiating tunnels that remain uncompleted within the Catacomb Caves beneath the Church Cemetery.

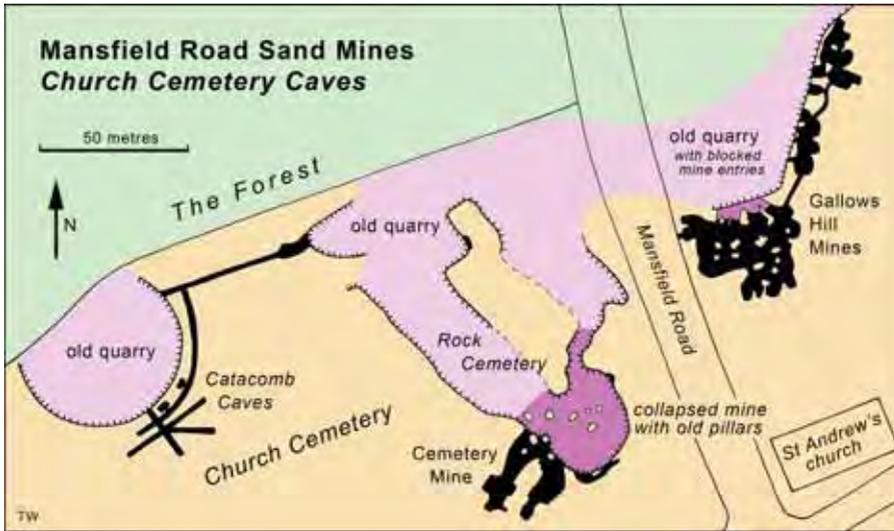
After the mine ceased working, its entrance was lost until it was rediscovered in 1827, and again in 1837. Shortly after, foundations for the new houses along Mansfield Road were cut into the mine to reach solid rock below, and may have destroyed a number of other original entrances. Barricaded behind the new brickwork, the mine was a tourist site in 1892, when it was advertised as “Robin Hood’s Mammoth Cave with thousands of coloured lamps illuminating the 2000 year old passages”. This notion and other fables of an ancient troglodyte fortress were equally distant from reality. Parts of the mine were subsequently used as air raid shelters in the Second World War. Two new entrances led onto stairways, cut into the rock, which descended more than 10 m to reach the northern end of the mine tunnels; the steps from Peel Street now provide the only open access into the old mine.

On the opposite side of the Mansfield Road from Rouse’s mine, there were some other much smaller mine workings, sometimes known as the Whiston mines, after the medieval village close to their site. All that is known of these is that there were at least five small galleries, recognisable as mines by their rounded patterns and the rounded rock pillars left in for roof support. Their entries were spread along 65 m of the low sandstone scars that originally faced onto the line of the Mansfield Road, and they were probably contemporary with, or a little earlier than, Rouse’s mine. Some of the mines became

extra cellar space beneath the Victorian houses subsequently built over and across their entrances, but all were filled with concrete when office blocks replaced the houses in the 1980s.

Further up the Mansfield Road, there were two more sand mines cut into the Mount Hooton scarp at Gallows Hill (with its macabre history as the site of the town gallows until 1827). The mines were associated with sand quarries dug in the 1700s in the waste land on both sides of the Mansfield Road. Because this area was waste, these were uncontrolled public sand pits, where people dug for their own sand. The early workings were therefore rather chaotic, and only some remain, with modifications from the 1800s. There were three original quarries, in a line, each working southwards into the steep slope. There must then have been either some restrictions on land take or some variation in the sandstone, because two of the quarries were extended southwards into mines. Entered by level drifts, these were both pillar-and-stall workings, very similar to Rouse’s except that they were not so extensive. They successfully exploited a zone of the sandstone much weaker and more friable than the rock forming the walls of most of the other caves in Nottingham.

East of the Mansfield Road, three sections of old mine which survive behind the old quarry wall are sometimes known as the Gallows Hill Mines. Very few pillars were left by the miners as they worked in from the foot of the quarry face, and consequently parts of the mines are now rather unstable. Houses have been built partly over the



The various old quarries, sand mines, collapsed mines and catacombs under and around the Rock and Church Cemeteries on Mansfield Road.

mines, and the Victorian builders wisely placed them on solid foundations that block the original entries to the largest mine. In 1940, the mines were modified for use as an air raid shelter; the three original mine sections were linked by two new short tunnels, and a new entrance from the pavement on Mansfield Road was created with a stairway that descends through a hole in the old mine roof.

West of the road, a similar quarry and mine lay on the site now forming the Rock Cemetery. The Cemetery Mine, as it is often known, was south of the quarry, as dictated by the ground slope, but the position of the original edge of the mine is uncertain. Records of an underground tramway within a sand mine may refer to this site, and could indicate that there was some system or order in the workings. However, planning was inadequate, because about 90% of the best sand bed was extracted, and the remaining rock pillars were too thin or too widely spaced. In 1806 a man by the name of Edward Hughes was killed in a rockfall, and in 1811 the Corporation broke down the mine roof, effectively turning it into an open quarry; this was probably in the interest of safety, but would also have yielded a good tonnage of new sand. In 1850 a ropewalk occupied part of the quarry floor, but by 1861 the whole site was incorporated within the Church Cemetery. The collapsed section of the old mine, with the stumps of its pillars still recognisable, now forms

the magnificent setting of the Rock Cemetery. Recessed into the sandstone wall around the heart of the cemetery, the three gated caves are the only surviving remnants of the mine.

The western quarry had no mines from it and was later landscaped into the amphitheatre that exists today. This was probably done around 1859-63 when the Catacomb Caves were excavated; they wrap around the perimeter of the western quarry, with access from a tunnel linking the two quarries. The scheme to create these underground burial chambers was unfinished when the catacomb company went bankrupt. Popular notions of Druid origins of the caves, and of any passages that link up beneath the Mansfield Road, are totally unfounded.

Other than those beside Mansfield Road, the only recorded sand mines lay along the south side of Derby Road, where it rises westward to Canning Circus; these were probably destroyed when the road was widened and graded in 1740. Elsewhere within the old town, sand was produced as a by-product of space creation whenever a new cave was excavated; clean sand probably found a ready market, but this production hardly counts as sand mining. Some of the caves under Malin Hill, along the Lace Market cliffs, are 3 m high, with rounded plans and profiles. Such heights and shapes are hardly conducive to efficient storage, and it may be that they were extended inwards and upwards to yield more sand specifically for sale.

Caves to the north of the city

The outcrop of the Sherwood Sandstone continues to the north of Nottingham, where its sandy soils favoured the large trees that form the ancient Sherwood Forest - after which the rock unit was named. A scatter of caves traces the exposure of the sandstone, but their numbers nowhere match those under the centre of Nottingham, because there was no pressure for factory or storage space in the rural areas.

The few caves in Arnold are mostly single, rather uninspiring house or pub cellars cut into the rock, but larger wine cellar caves were excavated beneath Arno Vale House and Sherwood Lodge. Many of the isolated sandstone scars have small caves, cut either as shelters or perhaps to yield clean sand; there are a few caves in a sandstone outcrop close to the church of St Leodegarius, in Old Basford, and Nanny's Cave lies close to the old quarries at Newstead Abbey.

Mansfield has a number of caves very similar to those in Nottingham. Church Street is on the line of a very old road that descends a shallow valley in the sandstone; where buildings were erected along its frontage, the slopes behind were cut back to create sandstone bluffs, and caves were then cut horizontally into these. A group of ten

caves lies behind the shops on the north side of the road, and includes rooms with rock shelves, chimneys and shafts. Some of these collapsed in 1994; the rather thin roof was already weakened by too many shafts through it, and the lack of buildings above it allowed rainwater to saturate the rock, thereby greatly reducing its strength - with the inevitable result. The remains of more old caves lie along Rock Valley and Ratcliffe Gate. Like the caves of Sneinton Hermitage, these were fairly civilised, with windows and doors opening into the cliff face; one was occupied until the late 1800s.

The caves at Creswell Crags are unrelated to the Nottingham caves, as they are natural features cut by solution and erosion of the Magnesian Limestone along the sides of the short gorge through the limestone escarpment. Their age is therefore measured in hundreds of thousands of years, but their fame arises from their occupation by people of the Stone Age. Neanderthal people lived in the Creswell caves about 40,000 years ago, but the relics of the important Creswellian culture were left by hunters of about 12,000 years ago, before they finally abandoned cave dwelling and took to building their own houses.

Tombstones within the Rock Cemetery stand between low stumps of bedrock sandstone. These are all that remain of the pillars that supported the roof of the old sand mine before its collapse and destruction in the early 1800s. Alcoves in the low sandstone cliff are the surviving ends of some of the galleries within the old mine.



The tunnels of Welbeck Abbey

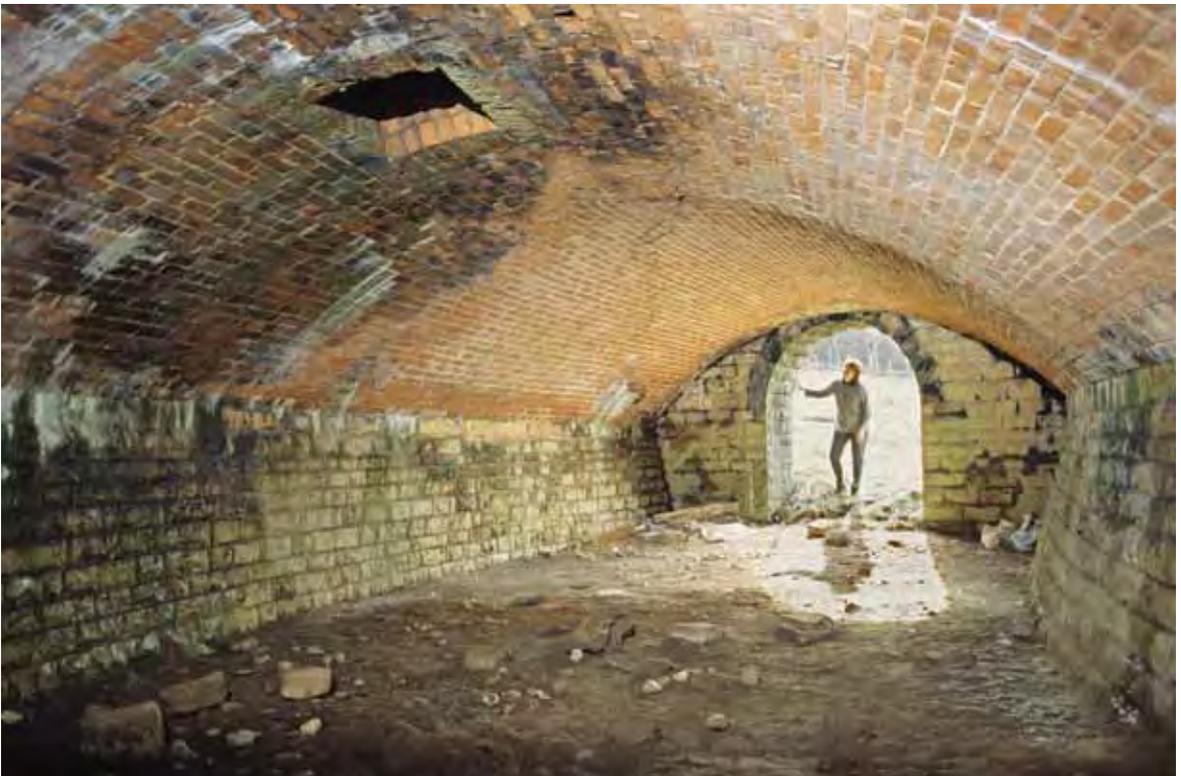
Some 30 km north of Nottingham, Welbeck Abbey stands in one of the largest estates in the county - and is also notable for its underground developments. Little remains of the Premonstratensian abbey, dating from 1155, but the huge country house was developed by the successive Dukes of Newcastle and Portland, after the dissolution of the monasteries in the 1500s. From about 1850 until his death in 1879, the fifth Duke of Portland was responsible for many of the fine estate houses and lodges, built with sawn blocks of local Magnesian Limestone. He also had a predilection for tunnels and underground structures.

The Welbeck tunnels are not cut into the rock. They are all cut-and-cover galleries, built in trenches excavated in the weathered Permian mudstones that form thick clay soils across the estate; walls and arched roofs were built of limestone blocks and brickwork, and most are also finished with a plaster lining. Soil was then replaced to cover the arches except where short shafts created skylights. Above the tunnels, the

restored ground surface is generally level, but the route of some can be traced as long thin ridges. Some tunnels are only 2 m high and wide, but most are large enough to take a coach-and-four.

The most remarkable feature of the tunnels is their length; they extend for at least 3800 m under the estate. The longest single tunnel is the underground carriage drive heading towards Worksop. This starts by the stables of the original riding school, and reaches northeast through the deer park to its portal at South Lodge; it is 1870 m long, though this includes one stretch of 170 m in a deep, brick-lined cutting with no roof. This tunnel also crosses the estate lake inside a clay dam, where the tunnel floor is well below water level, though the crest of the dam provides a dry walkway across the lake above the tunnel. Sadly, the long tunnels have not been accessible since they were walled up after the Abbey became a military college.

One of the long tunnels that extend beneath the Welbeck Abbey estate. A low wall of limestone blocks is set below the original ground level, and the arched roof is made of brick covered by a bank of earth.



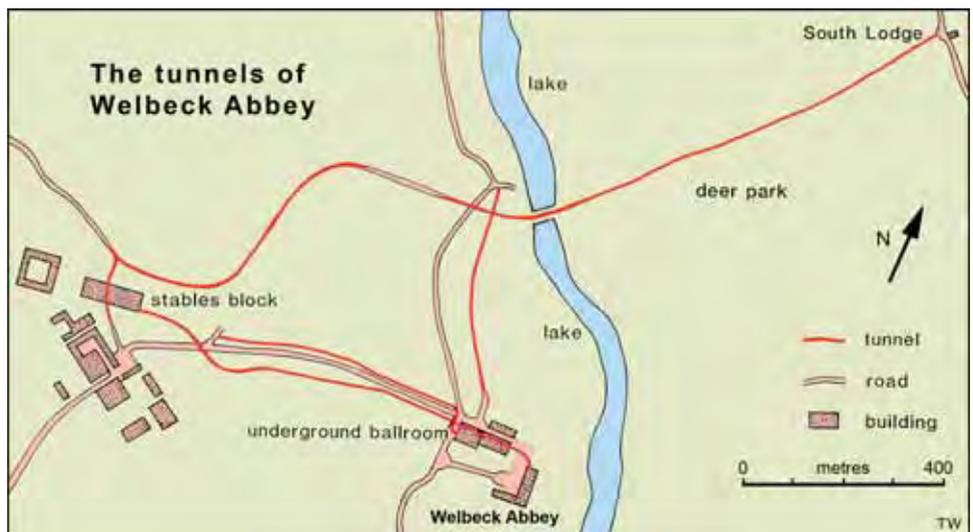
SANDSTONE CAVES OF NOTTINGHAM

Some tunnels connect directly into basements and corridors beneath the main house and outbuildings of Welbeck Abbey. These include the famous underground ballroom, 48 m long and 19 m wide. This too is just set into the soil profile with its ceiling at ground level, so that it is lit by skylights above its windowless walls. More tunnels connect to the underground library and other rooms, and those linked to the kitchens have railway tracks for the food trolleys.

The underground rooms and basements of Welbeck Abbey could be regarded as normal building practice where deep foundations are required on soft soil, though the underground ballroom is a little unusual. But the longer tunnels of Welbeck are totally bizarre, and there is no clear understanding or record of why they were built. The fifth Duke was a recluse; he enjoyed his privacy and tended to avoid his neighbouring gentry, but he enjoyed talking to the many workmen on his estate. It is quite likely that one reason for building the tunnels was to provide employment for an army of diggers, in a Victorian style of philanthropy. There is no evidence that he kept out of sight because he was disfigured, and his very successful development of the estate precludes any suggestion that he was mad. Perhaps it would be fair to describe the Duke as eccentric, and the Welbeck caves are thereby a whim of his eccentricity. Different from the sandstone caves beneath Nottingham, they are another distinctive feature of the county.



Whitewash lightens the brick and plaster walls of a tunnel that curves round and down to enter the underground ballroom beside Welbeck Abbey.



Outline plan of the main tunnels that lie beneath the estate and outbuildings of Welbeck Abbey.

The caves in modern times

The legacy of perhaps 1000 years of cave excavation in Nottingham is a scatter of caves beneath much of the city. There is a serious probability of a cave being known or found under almost any building, construction site or road within the old part of the town, bounded by the alluvial floodplain and the line of the Norman wall. Unfilled caves with thin rock roofs provide a special hazard for civil engineering works, and therefore encourage investigation of the ground on all development sites; our knowledge of the caves increases year by year. Building demolition frequently reveals previously unrecorded caves, but new foundation works commonly have to include destruction of some caves, or filling them with concrete.

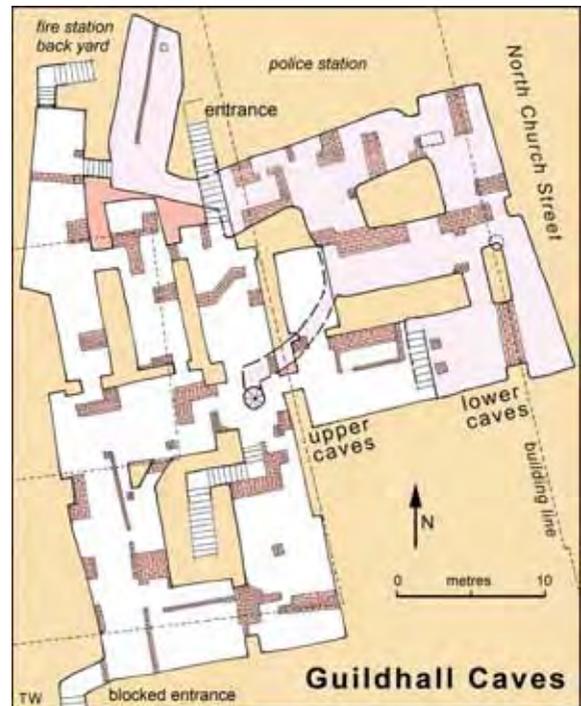
Caves have therefore been lost through Nottingham's redevelopment for more than a hundred years. Back in 1892-95, slum housing north of the Market Square was demolished and replaced by the office blocks on Queen Street and King Street. A number of pub cellar caves, and one great cave room 20 m long and 5 m wide with central columns, were among those filled with concrete. At least these caves were mapped and recorded before they were filled, and the same has happened at other sites. The caves beneath Stanford Street partially collapsed and those under the old Corner Pin public house were only revealed during site demolition; both these caves are now full of concrete, but their maps and photographs survive.

Unfortunately many other caves were not documented. An extensive series of caves lay beneath the Black Boy Hotel on Long Row, but these were filled with concrete when the modern store (now occupied by Primark) replaced the hotel; no detailed map survives, and a minimal record of the caves has been compiled only from distant memories, a few rough notes and a few photographs. In 1993, caves were exposed beneath the corner of Stoney Street and Goose Gate, at a significant site in the heart of the Lace Market; but they were quickly sealed behind brickwork, and no records or access remain.

The caves behind the old Guildhall, originally cut as wine cellars, but modified during the 1939-45 war.

Many caves were destroyed when basements or foundations were excavated to reach solid, non-cavernous rock to support new buildings. A century ago, a number of caves were broken out and destroyed in order to build the department store which is now Debenhams'; only two caves survive under this large site. More caves were destroyed for the basements of the Pearsons' store east of the surviving medieval cave beside Long Row, and only fragments of their entrance stairways were left in the rock. Victorian brickwork, that is a feature in so many caves, including Rouse's sand mine and the Drury Hill caves, shows how much history has been lost.

Fortunately, many caves have survived, and some are still being used. Those in use are dominated by the pub cellars, as they are excellent for the storage of beer barrels. Others tend to be used as little more than rubbish dumps, and many caves are too damp for storage of many materials. Throughout the city, many more of the caves had their entrances bricked up, and have then been forgotten. Since about 1900, the story was mainly of the destruction of the caves. But there have been some new additions, notably the phase of new cave excavation for air raid shelters during the Second World War.

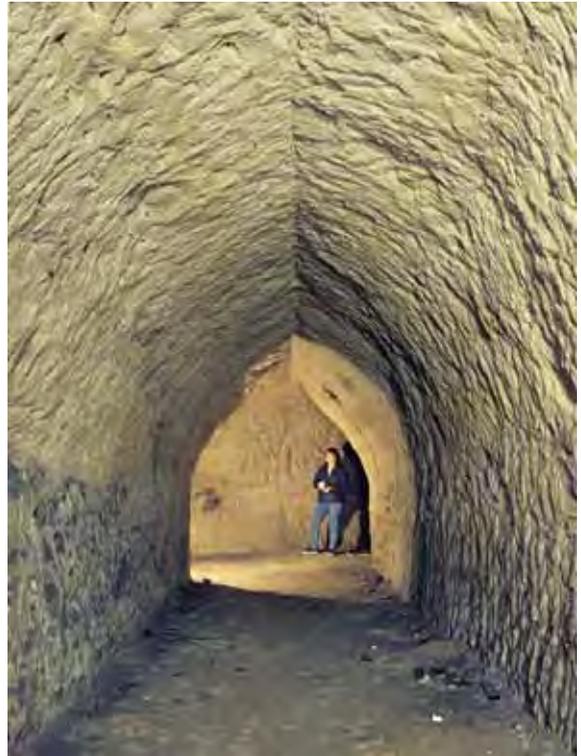


Air raid shelter caves

A deeply buried cave with a thick roof of solid sandstone, and an overlying cushion of earth and buildings, seemed to offer the best protection against most types of bombs that were likely to descend on Nottingham during the 1939-45 war. Consequently the early years of the war saw a burst of activity with the excavation of some new caves and the modification of others, while a few schemes for more massive new caves were shelved and forgotten.

The new purpose-built air raid shelter caves are distinguished by their extended linear form, with straight tunnels mostly only 3 m wide, lying at much greater depth than most other caves, and always with at least two entrances. To achieve more easily the depth and roof cover, they were mainly cut into sloping ground. The Lees Hill air raid shelter cave was cut into the modified cliff at Sneinton Hermitage, and another system was cut into the lower levels of Castle Rock. There are various purpose-built air raid shelter caves in the Radford area, including the largest, cut under the Player's factory and capable of sheltering over 8000 people. However most of the Player's tunnels were cut-and-cover excavations beneath the streets; they are brick lined, and were not cut in the bedrock sandstone.

Existing caves were also utilised or modified in anticipation of the air raid threat, and a city council register dating from February 1941 had 86 caves available as public shelters. Most of the larger caves that were easily accessible at the time appear on this register, and many had some modifications to improve their safety. A second entrance was obligatory; in some this meant that new flights of stairs were cut through the rock - as in both the surviving sand mines; in many smaller caves this was just a shaft with a vertical ladder, or, in a few cases, a narrow spiral staircase. Some caves had blast walls installed near their entrances; these were massive brick buttresses off-set to act as baffles and reflect some of the shock wave energy. Steel roof supports were installed in a few caves, though this was rather a case of over-design, and most had some form of electric lighting fitted. Short lengths of new tunnel were cut to link some adjacent caves and thereby improve access; these include the tunnels linking the three



One of the long straight caves that were originally cut as air raid shelters deep beneath Castle Rock.

sections of the old Gallows Hill sand mines, and also some of the many connections within the Drury Hill caves.

Two groups of caves are worthy of special note. The old wine vaults of Skinner and Rook beneath the buildings behind the Guildhall were fitted out for emergency use as the local Civil Defence headquarters. These extensive and spacious caves were ideal for the purpose, particularly when modified and strengthened by a plethora of blast walls, extra roof supports, concrete reinforcement, room dividers and a final total of five entrances. The strengthening was largely justified by the rock cover of only 3-5 m. Deep beneath Castle Rock, the new air raid shelter caves are characteristically long and straight, but they were cut with distinctive gothic arch profiles. One of the separate older caves under Castle Rock was used for the wartime storage of radium; this was ideal protection for such a sensitive material, but it did require a very thorough clean out in 1953.

Collapse and loss of the caves

Nottingham loses many of its caves in the cause of redevelopment and building reconstruction, but over the years caves are also lost through collapse and rock failure - which may be either natural or artificially induced. Nearly all the caves which are set deep into dry sandstone, and lie underneath buildings, are perfectly stable. Some have already lasted 1000 years, and show no sign of decay or distress. The dangers to caves all come from the outside. Natural threats are rainwater seeping down through exposed rock, tree roots growing into the shallowest layers of the sandstone, and cold, damp air coming in through open entrances. Rainwater reaches almost all the ground at shallow depths, and is so destructive because the sandstone loses much of its strength when it is saturated. Water is therefore also the main artificial hazard, when it escapes from broken drains and leaking mains, then seeps through the cave roofs. Heavy loading by new buildings is the other man-made hazard.

Debris from a large roof fall lies on the floor of a cave under Wollaton Street. Soon after the fall occurred, a load-bearing brick wall was built along the centre of the cave to ensure stability of the road directly above.

The most vulnerable caves have been those which open into the sandstone cliffs, notably at Sneinton, along the south edge of the Lace Market and around the Castle. These caves are, or were, exposed to all the natural forms of rock weathering; they have a long list of failures, which effectively constitute a style of cliff retreat. Significant rockfalls have been recorded from the cliffs of both Narrow Marsh and Sneinton Hermitage, in each case destroying a number of houses below.

Away from the cliff lines, there have been few recorded total collapses of caves and not many more roof falls of less dramatic scale. There appears to be just one recorded case of a building falling into a Nottingham cave, and there are just a few known cases of streets collapsing into the caves. There have almost certainly been more failures that have passed undocumented; most would have occurred on redevelopment sites and would have been rapidly remedied or filled in by the contractors at work. In many of these cases the disturbed ground merely dropped into unsuspected caves, either during removal of an old building floor, or when bedrock sandstone was being excavated to create new and lower foundation levels.



Weathering and rock decay

Almost any cave beneath a building is effectively protected behind closed doors, but exposure to the open air can be the death knell for a cave in Nottingham's sandstone. Natural draughts lead to repeated changes of temperature and moisture content of the cave air and of the rock surfaces; even more significantly, the winter brings frost weathering. Under these conditions the sandstone just disintegrates as its natural clay cement fails, and individual sand grains fall away. This rotted rock is present in many of the caves in the sides of both Castle Rock and Hollow Stone - but only in those with unsealed doorways; the caves with bricked up entrances, and those further in from daylight, show none of the weathering.

In Thomas Herbert's ornamental caves in The Park, the sandstone matrix has weathered back, so that quartzite pebbles within the rock now project from the wall. These indicate the approximate profile of the original cave, and show that weathering has taken 10-20 mm off the walls in about 130 years. Fallen grains of loose sand form a mini-scrée at the foot of each wall, and it is noticeable how much the weathering decreases away from the entrance; the statues and wall detail higher up the Haddon Hall staircase are much better preserved. The remedy for this style of cave disintegration is simple - a tightly fitting door that is only opened when access is needed. Consequently, in 2005, doors and shutters were installed on the daylight openings into Daniel's Cave, since when the weathering of the cave walls and the rock statues has been hugely reduced.

Tree roots can be surprisingly destructive. They find their way down the narrowest of joints and the tightest of bedding planes within the rock; then in a warm dry summer they probe deeper in their search for water. As they lengthen, they thicken - and just heave the rock apart. Trees that have been growing over Castle Rock are causing some major problems; one fracture in a thin cave wall was measured to expand 8 mm in just two weeks. Roof falls and cave collapses are almost inevitable when the rock is torn apart on this scale. The thin sandstone roof over a cave beside North Sherwood Street collapsed through to the surface in 1993,

and the fallen rock was almost surrounded by the growing roots of trees and shrubs.

Weathering, rainwater input and root action would all have been significant factors behind repeated collapses of the sandstone cliffs with caves cut into them. The year of 1829 was remarkably bad, with two collapses at Sneinton Hermitage destroying some caves and parts of the two public houses; in the same year, a rockfall destroyed five houses along Narrow Marsh, where Cliff Road now lies. With the caves already cut into the face, and the rock steadily weathering away, there was no simple remedy for the cliff failures. At both sites, the cliffs were subsequently cut back and many caves were destroyed - especially along the eastern part of the Hermitage. The same pattern, of cave collapse followed by cutback of the cliffs and excavation of a new set of caves, has probably been repeated many times over the centuries along all the city's southern cliff line. Unfortunately no older records have survived, and the earliest caves predate any reliable maps.



In Thomas Herbert's herbarium cave, projecting pebbles and a bank of fallen sand along the foot of a wall indicate the loss of the sandstone by weathering.

Cave collapses due to water

As is typical of weak sandstones, the strength of the Nottingham Castle Sandstone declines significantly when it is saturated with water. The saturated strength of samples taken from various caves has been found to decline to between a half and one fifth of the dry strength. The clay cement between the sand grains permits some plastic deformation of the rock before it fails by fracturing. Major bedding planes are scarce, though some beds rich in pebbles and mud flakes are significant weaknesses.

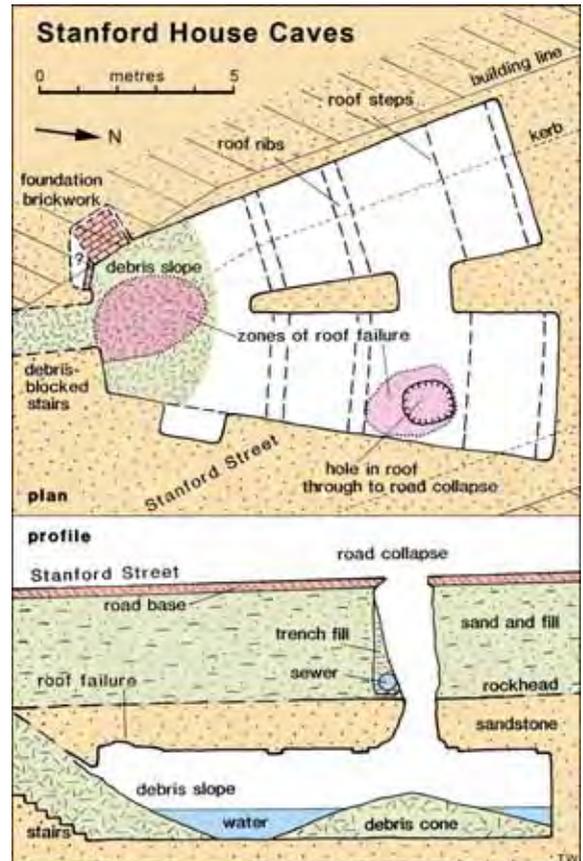
Much of what looks like uniform sandstone breaks into beds only 10-20 mm thick when saturated and in tension – which is how failures can evolve in the unsupported roof spans of caves. The process continues by progressive

collapse, so that the cave ceiling migrates upwards above a growing pile of debris on the cave floor. Ultimately, the failure may reach the ground surface, causing an abrupt collapse, which is known as a crown hole. No complete failure cycle has yet been monitored, but spot observations suggest that a time scale of years may be involved between the rock first becoming saturated and the crown hole suddenly appearing. Collapse may be more extensive where pillars or rock walls between a group of caves become saturated to the point of failure.

Where caves are not protected underneath buildings, rainwater soaking into the ground has caused the critical weakening of the sandstone at a number of sites. Failure of the caves behind Church Street, in Mansfield, was largely due to rainwater entry where the site above had been



The crown hole collapse in Stanford Street; most of the open hole is in soil and fill, but rock is just visible around the dark hole breaching the cave roof.



The forgotten undercroft caves beneath Stanford Street that were revealed by the collapse of the road in 1990, before they were filled with concrete.



The south end of the Stanford Street cave with debris blocking the original doorway. From the beautifully arched roof, sandstone is breaking away in the very thin beds that are only apparent where it is saturated and in tension; fallen slabs form the lighter material on the debris pile. The cave is now full of concrete.

cleared and left as an unsurfaced and undrained car park. In the same manner, the medieval cave under the Pearsons' site on Long Row stood unblemished for over 600 years, until part of its roof rock was exposed by demolition of the department store in 1990, and a small collapse occurred in the cave. Fortunately the sandstone does regain its strength when it is dried out; a waterproof bitumen seal was rapidly placed over the rock exposed within the site, and it now lies beneath new buildings, so no further failures have developed.

A cave near Short Hill completely collapsed in 1826, swallowing a garden and reputedly killing seven boys who had been playing there. The collapse of the Cemetery Mine in 1806 was beneath just a few metres of weathered sandstone that was exposed to rainfall on open ground, and recent collapses in the adjacent and equally shallow Gallows Hill Mine have been beneath cultivated gardens. In contrast, the extensive galleries and rock pillars in Rouse's sand mine

remain clean and fresh after 200 years, as they lie 5-10 m down in sound rock that is largely beneath buildings and drained roads. The effect of rainfall input on weathered sandstone is clearly disastrous for any caves at shallow depth, and an overlying, undrained garden is therefore the greatest hazard to any cave.

A broken drain or a leaking water main is sure to cause a failure if the escaping water finds its way through a cave roof. In June 1990, a crown hole collapsed in the middle of Stanford Street due to failure of a cave below. The cave entrance had been blocked and forgotten many years previously, and the cave was only rediscovered when the road collapsed under the wheels of a large delivery truck. A water main under the

street had been gently leaking for some unknown period of time, and the water had soaked down through the soil and sandstone. Hidden from sight, the cave roof had progressively failed, at an unknown rate, eventually causing over a metre of sandstone to fall away, and so exposing rockhead within the cavity. Subsequent failure of the soil, into the cave, must have been more rapid, until a cavity was created that was bridged only by the un-reinforced road base and its blacktop. This then failed under the weight of the truck, as a characteristic, unexpected crown hole collapse. The new hole was more than 5 m deep, with vertical and overhanging sides. When the cave was entered, water was found to be seeping in through another part in its arched roof, and the sandstone was breaking away in the thin beds that are typically revealed where it is in tension, so the whole cave was filled with concrete.

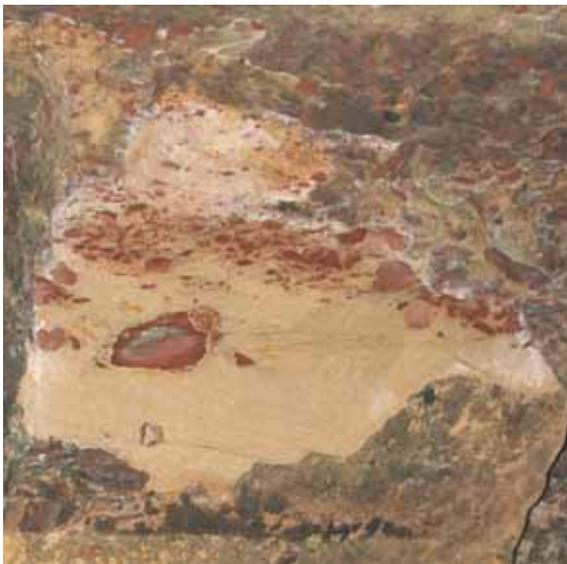
At the Black's Head site, just west of the Broad Marsh Centre, water from broken drains soaked into the rubble fill of the malt kiln cave; this therefore saturated the sandstone of the kiln floor, which then collapsed into the old pub cellar cave beneath. The multiple levels of the caves made this collapse unusually complicated, but the role of the water was typical. Stemming



The pile of debris that landed in the lower of the Black's Head caves when the saturated sandstone and the soil fill collapsed in the malt kiln cave above.

the flow of water from a broken pipe can prevent further failure of a cave roof, as the sandstone recovers its strength when dried out. A small collapse many years ago in the Pillar Cave, beneath the Broad Marsh Centre, and another in a cave near Clumber Street, were due to pipeline leakages, but the caves have been stable since the water flow has been cut off. The Stanford Street cave could have been saved by repairing the water lines in its roof, but conditions at the site made this a complex and expensive option which was therefore inappropriate.

Though most of the cave collapses under Nottingham are related to water, failures of dry caves do occur. In 1997, a large roof failure in a cave under Wollaton Street was triggered by the shock wave from the collapse of a retaining wall that had stood near to the cave but not directly over it. In an unrelated incident, a thick slab of sandstone fell away from the roof of the Adams Brewery caves, where there was no sign of water entry, and no previous pattern of heavy rainfall. This failure and other smaller ones like it can only be ascribed to very slow weathering and deterioration of the sandstone, too subtle to be directly observed or monitored - until a block falls away. The long term effect is still one of extremely slow rock disintegration, but the momentary effect of each block failure could prove disastrous.



A small roof fall in the Brewhouse Yard caves exposed an abundance of red clay flakes within the sandstone; these caused the fall by their swelling with absorption of groundwater in the normal course of weathering.

Failures of loaded cave roofs

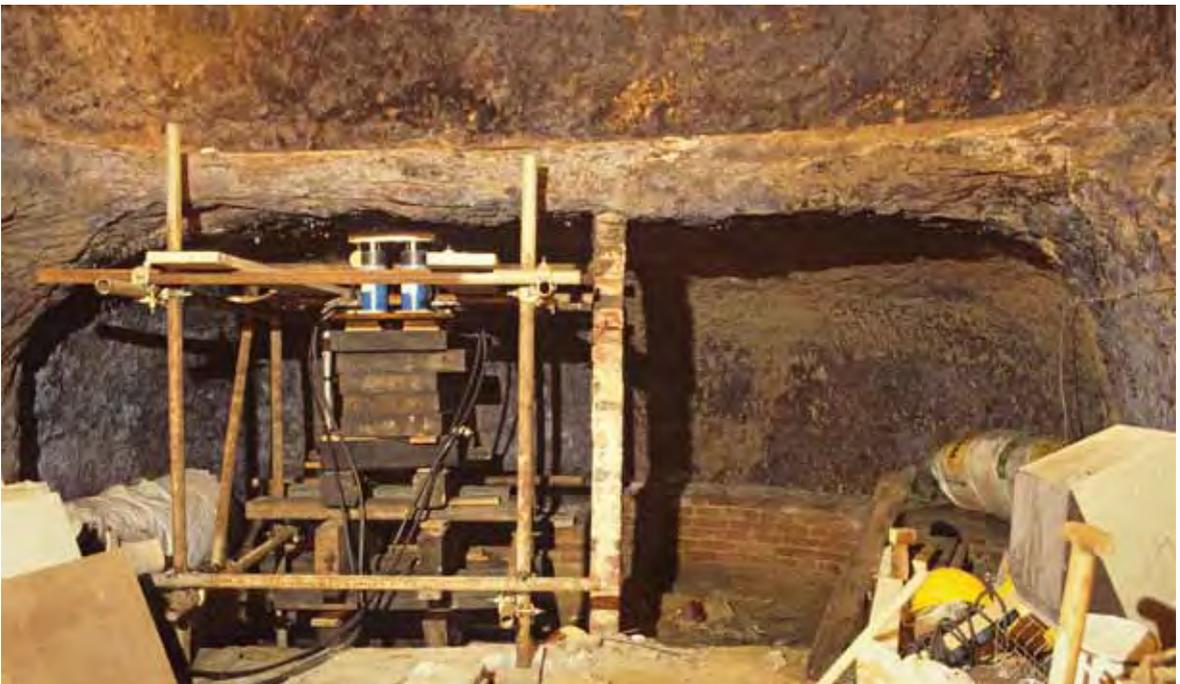
The stability of a cave roof depends not only on the rock strength, but also on the roof thickness and the cave width. Over most caves in Nottingham, the thickness of sound rock is generally 1-3 m, discounting any rock that has weathered to a dense sand of insignificant strength. Roofs much thinner than a metre would generally fail during the disturbance of cave excavation. Thicker roofs do occur, over part of Rouse's sand mine and over some beer cellars in pubs; the Golden Fleece cellars have 5 m of rock cover, probably because they were excavated in the softer sandstone bed that was also exploited by the nearby sand mine. The Lion Hotel caves also have 5 m of rock cover, but for no apparent reason; the caves could not be any deeper as the floors are at the water table. The cave cellars are 11 m down under the Running Horse, on Alfreton Road, but this is because the pub stands on a terrace of made ground, and there is only the usual 2 m of solid rock over the caves.

In general, a maximum span for the cave roofs is about 5 m, reached in the Plumptre House caves, in the Shipstone's Brewery caves, and in the Western Caves under Drury Hill. Most caves

wider than this, and many that are narrower, have rock pillars in them. Some pillars are less than half a metre wide and probably have more ornamental benefit than structural use; in other caves, more substantial pillars were clearly left to provide roof support. A cave under Wollaton Street is up to 11 m wide, with a remarkably flat roof profile; it had no central support until a load-bearing brick wall was built in it in 1997 after a minor roof fall and concerns for its total stability. Most of the caves were cut with the roof forming very gentle arches, though many of the younger caves have nearly flat roofs. There are variations; the Stanford Street caves have semi-circular profiles with ornamental ribs, and the roof of the medieval cave under the old Pearsons' site is a spectacular complex of three-dimensional arches between its flared pillars.

Building regulations in Nottingham base their requirements for foundation design on a safe bearing pressure of 100 tonnes per square metre

Preparing to load to failure the thin sandstone roof within the Commerce Square caves, as a full-scale destructive test. Hydraulic rams applied the load upwards, so that everything did not fall to the ground in the inevitable failure. Failure eventually occurred with an applied load of more than 30 tonnes.

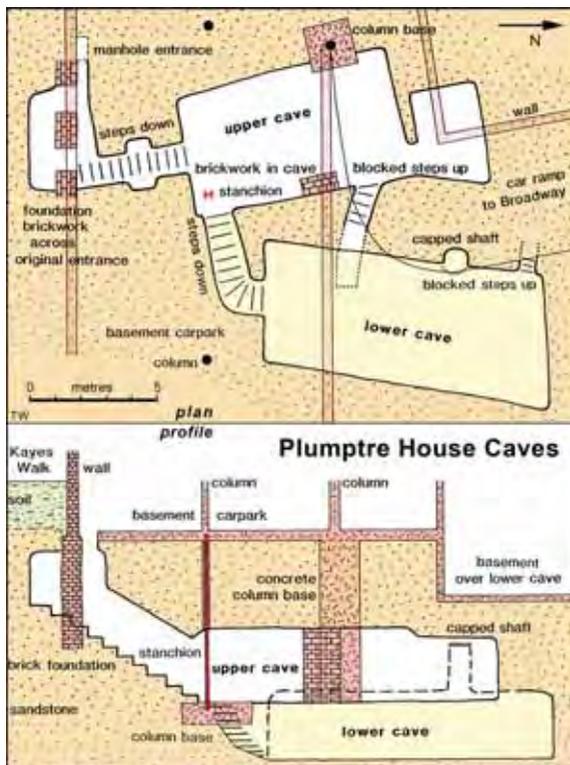


(1 MN) onto sound, unweathered sandstone. Any caves under a site could reduce this design value, so their influence on foundation integrity has been thoroughly investigated. Research has included loading scale models to failure, analysing mathematical models on computers, and also test loading one cave roof to destruction. All these tests have shown that the presence of a cave is just about irrelevant where its roof is thicker than 3 m, in the worst possible case of loading on a foundation pad 1 m across directly over a cave. With thicker roofs, loading causes crushing of the rock before failure of the cave. Cave roofs less than 3 m thick can collapse under excessive loads. A cave roof about 2 m thick fails at roughly half the load that causes failure of solid rock, and the failure load is roughly halved again over a cave roof just 1 m thick. Caves 5 m or more in width do fail under even more reduced loads, but the influence of a cave declines hugely where it is offset so that it is not directly below the loaded foundation.

The threat of a cave lying unseen beneath a foundation is clearly recognised, and is effectively eliminated by the modern practice of drilling test holes on all construction sites on the Nottingham sandstone; these have to prove that there is at least 3 m of solid rock beneath all foundations. This practice proves that there is enough ground adequate for safe construction, and variations to the general case are applied on some specific sites where caves are known or heavy loads are planned. Research has shown that the guidelines do incorporate large factors of safety; additionally, design loads are normally well below the permitted maximum. Thanks to these precautions there has been no building failure due to a cave collapse in recent times.

The only recorded loading failure of a cave roof occurred during the 1800s; the pillar of a building frontage on Albert Street (now occupied by the Marks and Spencer store) was inadvertently built over the crown of a cave, and subsequently collapsed through into it. There have also been a number of “near misses”. The footings of 17 Castle Gate rest on only a metre of rock spanning a cave 3 m wide. A stanchion inside the old Pearsons’ store stood directly over the centre of the lower cave supported by little more than a metre of sandstone (until the cave was filled with concrete); both these structures survived, though they could never have been erected under the constraints of modern building regulations.

Rock failures within the caves have occurred in recent times, but have only been on a small scale. The caves behind the Brewhouse Yard Museum were temporarily closed after a section of roof fell away; slow deformation of a wide arch, over the cave entrance in the cliff face, had created new internal fractures that left some of the rock unsupported. This collapse was unusual in its style, but it shows how the rock can slowly deform and weaken under load. Inside two other caves, sandstone pillars left for roof support have cracked and started to disintegrate where they were cut too slender for the loads imposed on them. Centuries of accumulated experience with the sandstone in the Nottingham caves have made simple failures a rarity, but there is always some risk where the rock is highly stressed and is losing its strength due to natural weathering.



The caves that once lay beneath Plumtre House, with the foundation works of brick, concrete and steel for the Victorian factory now redeveloped on the site

Finding the lost caves

With so many caves already known in Nottingham's sandstone, the ground under any new building site has to be carefully investigated, to ensure that any open holes in the rock are found and evaluated. Inside the medieval town wall, caves are likely to be found on almost any site, and searches need to be thorough. Outside this area, the sandstone outcrop may still contain caves, but the chances of finding unknown caves are greatly reduced; out-of-town caves are likely to be already documented, as these are mainly the newer ones.

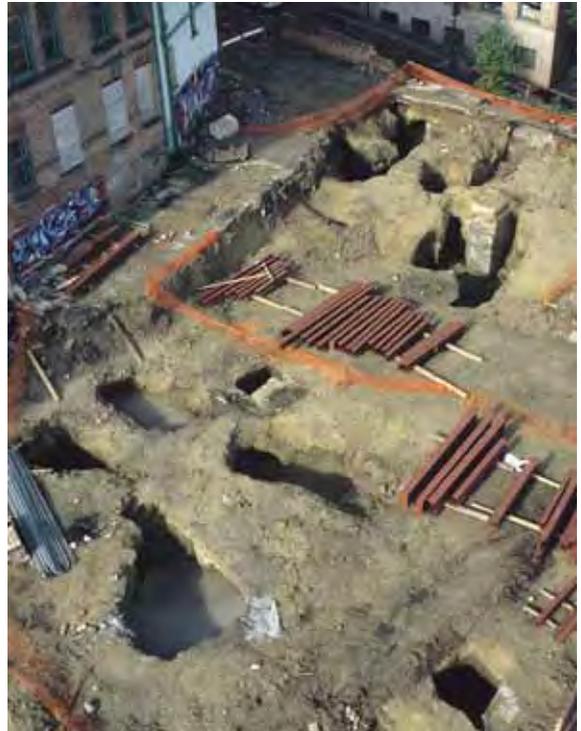
Records and maps of the Nottingham caves were notoriously scattered until the British Geological Survey compiled a single register. This records close to 500 caves, with their locations, size and depth, plans and descriptions where available, and state of filling or access if known. However the register can only record caves that are accessible or whose maps can be traced, and the problems for site developers are the unknown caves that have been lost and forgotten.

Site clearance and demolition frequently reveal unsuspected caves. Access can then be gained and they can be accurately and quickly surveyed. Many have entrances that have been bricked up, and some have walls inside them underneath old property boundaries; judicious removal of brickwork is always the cheapest way to reach and assess any caves. When the old Corner Pin pub was being demolished, a contractor just moved a sheet of plywood standing against a wall - and revealed the shaft down to the group of caves that had been long forgotten and were unrecorded; the stairway down to the caves was then found behind a brick wall in another cellar.

It can rarely be certain that all the caves have been found beneath a site, and project engineers therefore have to resort to rock drilling. The sandstone beneath every planned foundation is drilled to prove the presence of solid rock, normally for at least 3 m. Most of this probing is simply done with a hand-held pneumatic drill fitted with extension steels, and this basic equipment can be carried into constricted sites beneath buildings that are being redeveloped. Mobile drilling rigs are used on larger open sites where many probes are required. Probing found over twenty caves before construction of the new

Ice Stadium, though none was of any great size. Another large site was drilled by over 1200 probes, and not a single cave was found; hardly surprising, as the site was outside the old town limits, and had already been excavated to well below the old ground level, removing all the sandstone in which caves would have been cut. That investigation could be regarded as a case of excessive caution, but the cost of the probing was still small in comparison to the potential cost of a structural failure due to a cave collapse. An unknown hole in the ground is a potential hazard, whereas it is normally possible to design a structure around or over any known cave.

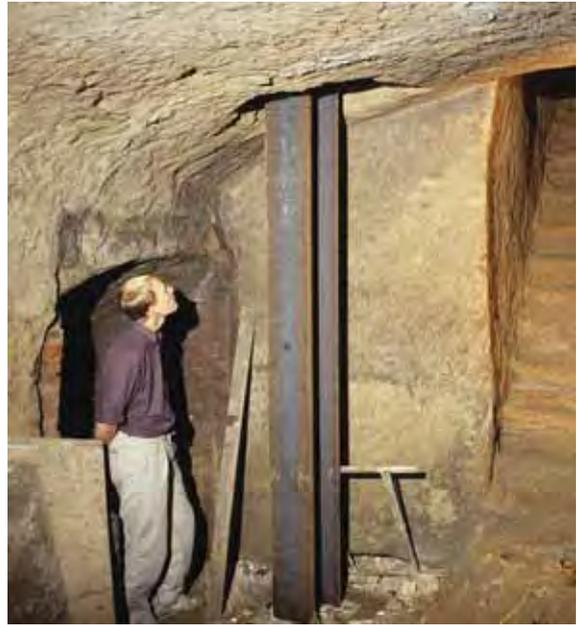
Ground can also be investigated by geophysical surveys, and micro-gravity measurements are good at indicating the presence of open caves, though confirmation relies on follow-up drilling. One survey pointed to so many caves under Belward Street in the Lace Market, that the construction project was redesigned; so the caves were never investigated, and they remain unseen.



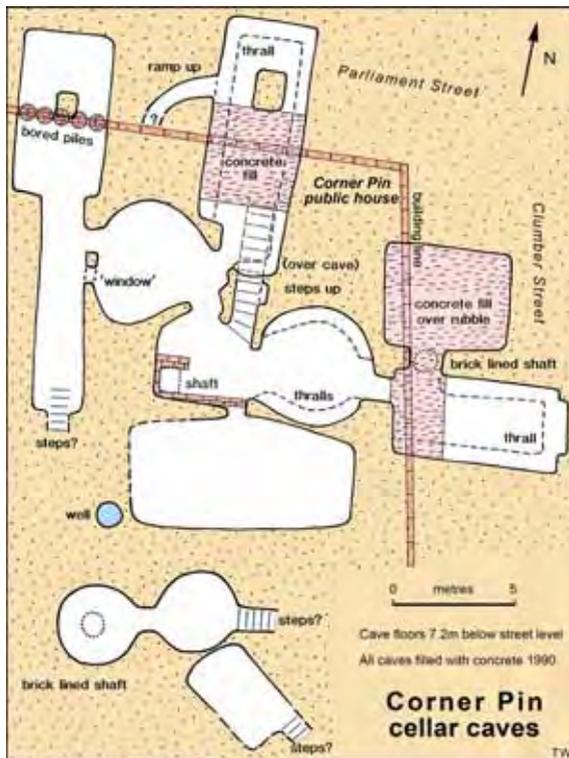
Many small caves unroofed and filled with concrete where a block of flats was built beside Hollow Stone.

Building over the caves

Where caves are found to exist beneath a construction site, the three basic alternative courses of action are to fill the cave, add support inside the cave, or design the structure to bridge the cave. Each site is different from the next, and which procedure is appropriate depends on the balance between the cost of the engineering works and the historical value of the cave, and hence the need for its conservation. Single caves that were once house or pub cellars can rarely justify much expense to preserve them, and once they have been mapped and recorded they can simply be filled with concrete. In contrast, larger groups of caves or more unusual features can have considerable heritage value. It is fortunate that some of the more caring developers within Nottingham have put some thought and a portion of their budget into conserving the caves beneath their new buildings.



A steel I-beam stanchion reaches through the cave under Plumtre House to carry the load of a newly developed building down to a firm footing.



Caves found during redevelopment of the Corner Pin public house on Clumber Street, with an initial stage of partial concrete filling. The three southern of steps and parts of the cave walls (marked by broken lines) were not fully exposed before filling with concrete.

Filling a cave with concrete does re-establish solid ground for any building foundations, but is terminally destructive of any potential historical value. The Stanford Street caves were filled in 1990, and this was appropriate, even though a fine cave was lost. The filling operation cost many thousands of pounds, but the cave had two zones of active roof failure, there was no access except through the collapse, and structural work to carry the road safely over the cave would have been very much more expensive. Contrast was provided by the caves under the Corner Pin public house. These were initially only partially filled in zones under the lines of the load-bearing exterior walls; mass concrete was poured behind breeze block walls which were built within the caves. This was a successful compromise which conserved at least some of the caves. However, these too were subsequently, and unnecessarily, filled with concrete after a new site engineer demanded the simplest line of progress and cared not at all for Nottingham's underground history.

Just as destructive as a concrete fill is the total excavation of all the rock containing any caves and its replacement by basements. On Long Row, the Victorian department store built for Griffin and Spalding (now Debenham's) had more

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basements than was originally planned, when multiple levels of caves beneath the sloping site were nearly all cleared and destroyed to reach sound rock for the foundations.

The most obvious compromise between engineering safety and conservation is the placing of solid support within the caves directly

beneath the lines or points of structural loading. Many of Nottingham's caves have thick brick walls or columns built entirely inside them; these were added long after the caves were excavated to prop the roof so that they could carry the loads of new building foundations placed immediately above. Various sections of complete or partial walls have been placed in the Guildhall caves beneath load-bearing exterior walls of the buildings, in addition to the brick walls which were placed purely for blast deflection. A free standing brick column underlies an exterior wall of the Salutation Inn, and spur walls of brickwork have been added in the Plumpton House caves, the Hickling Laing caves and many others. One Victorian architect hastily built support walls of brick inside a cave that he found beneath less than a metre of rock - on which a new warehouse wall had just been built.

Concrete columns have replaced brickwork in modern construction. A series of concrete column bases are visible in the walls of the Drury Hill caves, and each lies beneath a main structural element within the Broad Marsh Centre. End-bearing piles, of either steel or concrete, can be placed right through a cave; they effectively become columns which pass through the roof rock without supporting it. These are built by digging or drilling a large diameter hole clean through the cave roof, and the pile is then placed through it and onto the cave floor, or onto a normal column base which is cut out of the floor rock. The old Nottingham Brewery caves, on Mansfield Road, have two sets of foundations passing through them. York House was built in



Pillar Cave in the Drury Hill tannery, protected beneath the floor slab of the Broad Marsh Centre, as it was before its development within the caves tourist site.

Profile through the Broad Marsh Centre showing the massive concrete beam that spans the caves. The beam lies almost over the narrow rib of sandstone between the Pillar and Tannery Caves.



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1962, on cylindrical, cast concrete columns that reach through the caves to concrete bases set into the cave floors. These are very neat in comparison to the massive column bases formed within the northern end of the caves, which are the sad contribution of the adjacent office block, built in 1996.

Foundations designed to bridge over the caves offer the ultimate in cave conservation. In recent times, various buildings have been safely established on strip foundations that have been reinforced with internal steel where they pass over caves; these distribute the load away from the cave roof, and would also span any small void caused by collapse of the cave. Office blocks fronting onto North Sherwood Street were built in 1992 directly over part of Rouse's old sand mine. These have shallow footings that were designed in a pattern to cast load onto the stable sandstone pillars between the open galleries, which therefore remained undamaged.

Concrete columns pass straight through the old Nottingham Brewery caves to support the modern office block of York House, beside Mansfield Road.

Difficulties and costs increase where larger cave systems have to be spanned, but the scope of the technique is well demonstrated by the Broad Marsh Centre, which was built over the conserved Drury Hill caves. The caves are so close to the ground surface that the foundations could not bear on the thin roof rock, and the planned structure would have needed a massive concrete column placed inside the northern corner of the Pillar Cave close to the Tannery Cave. This was clearly not acceptable, so a deep concrete beam spans the caves from solid rock on the north side to a column in front of the Tannery Cave. The beam is 20 m long and spans 12 m of cave, supporting the column of the building above at close to its mid-point. Similar ground beams and a reinforced raft could have supported the new offices built in 1966 over the malt kiln caves on Castle Gate, and so have avoided placement of the concrete columns within the caves; this cave complex is only a maximum of 11 m long, but there could have been difficulties in establishing footings without encroaching on adjacent properties.



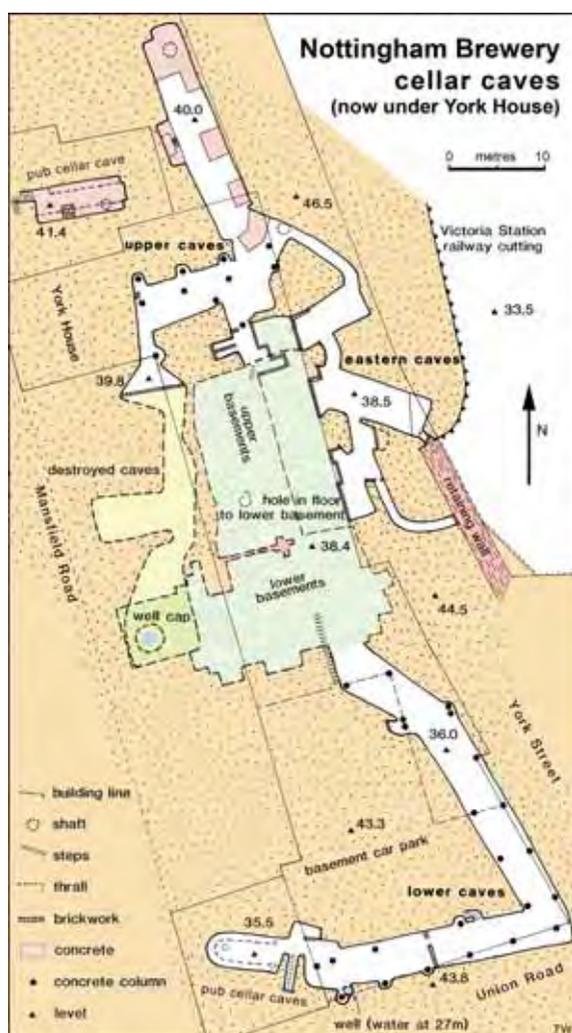
Conservation of the caves

The list of Nottingham's caves is changing every year. Destruction and losses have been going on since Victorian times; caves are filled with concrete, or with less permanent rubble and debris, entrances are sealed, brickwork supports damage cave interiors, and brick walls have been added inside caves beneath surface property boundaries. On the positive side are the new discoveries. In recent years the best of these have been found during building demolition prior to redevelopment. Notable are the Plumtre House caves, with their two large rooms, the Corner Pin

caves (though these are already filled with concrete), and six new malt kiln caves, including the well preserved malting complex under another part of the Plumtre House site.

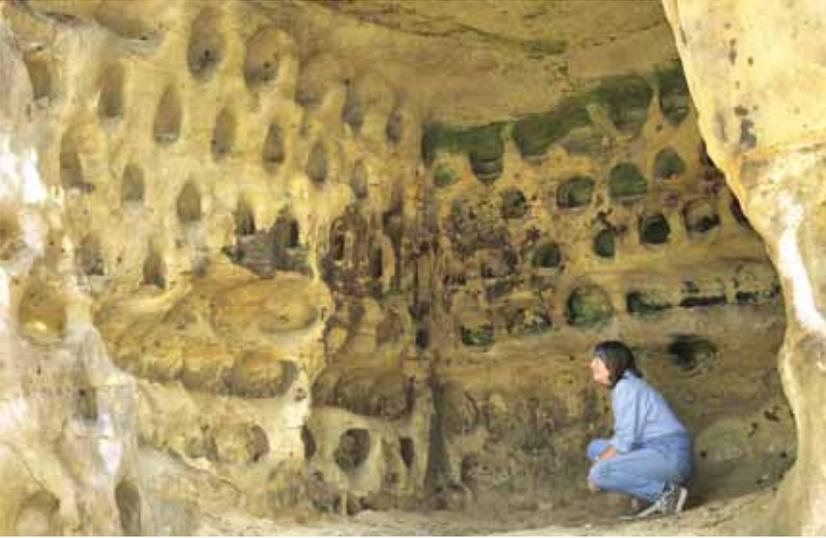
Some losses are inevitable when urban development is driven by economic forces. Damage can be minimised, but concrete filling, or total excavation, is permanent. There is therefore a clear need to fully record any caves before filling, so that they can take their place in the historical profile of the city. The Corner Pin caves were prematurely filled under a site engineer who was distressingly proud of his lack of historical interest. The record that was compiled was gained partly under a more sensitive predecessor, and subsequently largely by good luck. The site was potentially important, next to a gateway in the old town wall, yet the unusual window between two of the caves was never fully revealed and the site drawings of the southern caves were hopelessly inadequate. There was no real need to fill the caves; the old building had stood for many years (with the cave entrances concealed in the basement), and planning restrictions prevented the new one from going any higher. Another cave along Clumber Street was needlessly filled with concrete merely because that was the easy option for competing developers of adjacent sites that lay above it.

At present, six of Nottingham's medieval caves are scheduled Ancient Monuments. These are the Castle Rock caves, Lenton Hermitage, the complex of caves on the north side of Middle Pavement, the Drury Hill caves under the Broad Marsh Centre, and the malt kiln caves of both Drury Hill and Castle Gate. Thomas Herbert's ornamental caves and the Park Tunnel are Grade II Listed Structures, since they were included within the conservation policy for The Park. The Salutation Inn cellar caves, the old Pearsons' caves, and the Willoughby House wine cellar caves, are among those in the city centre that lie beneath listed buildings, and should thereby receive protection. In most cases, the cave protection is a consequence of the building protection, and some significant caves, including Rouse's sand mine, are not protected where they lie beneath unremarkable buildings. Most caves do lie beneath single buildings, but any which extended beneath adjoining properties would lose protection, because land ownership is



The caves beneath York House, which were originally the beer cellars of the Nottingham Brewery and two older public houses; some caves have been destroyed.

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A cave in the western end of the Lenton Hermitage cliff, with wall recesses cut into the sandstone for use as a dovecote; it is now one of the group of caves conserved and protected behind the Park Rock apartment blocks.

determined by surface boundaries. Further national protection is unlikely to be great, so the conservation of nearly all Nottingham's caves, both listed and unlisted, relies on the departments of the City Council recognising and appreciating their role and values.

Some protection of the caves is now provided by the Conservation and Design Policies that refer to archaeology within Nottingham City Council's current Local Plan. This policy does now provide scope for cave conservation on a scale that greatly improves on the past situation, when awareness was low and so many caves were destroyed.

The main threat to the caves comes from building redevelopment, and the council's building control unit has to ensure the structural integrity of the buildings - perhaps at the expense of caves that could affect the foundations. A clause in any planning permission requires that the city's archaeologist is given access to any previously unknown caves that are exposed by the site works. This relies on the contractors advising the council of any discoveries, and, because of potential consequent delays, there is some incentive for irresponsible site operators to quickly conceal or fill any caves. Then, even though regulations are in place, some caves have still been damaged when lines of communication have weakened between the conservation, the archaeology and the building control sections within the council.

Within the structure of Nottingham's local government, there is still considerable scope for improving conservation of the caves and their heritage. Some of the best conservation in recent years has been through the unsolicited actions of private developers. The caves of the Lenton Hermitage site were in a parlous state until they were cleaned out and then admirably presented on display as part of the new Park Rock development. Sadly, there are other sites where opportunities have been lost.

Progress takes time, but the future for Nottingham's caves is definitely looking brighter. It can reasonably be hoped that protection of the caves will be increased still further as their vital contribution to Nottingham's heritage is more widely appreciated and then recognised within the city's planning policies. Positive progress should include more sympathetic foundation design, and the bridging structure beneath the Broad Marsh Centre already shows what is possible. Often all that is needed is the right concept and an appreciation of the values of environment and heritage. During reconstruction works on the site where the Plumptre House caves were found, a tower crane had to be installed with its base partly over the lower cave. The developer took an imaginative approach by supporting the cave roof from inside, with a temporary structure of timber beams and screw jacks; as an added precaution this was very adequate, and it left the cave undamaged.

The caves as a resource

All too often, caves accumulate debris and rubbish that is seldom cleared out, and they then become valuable repositories of abandoned items from times past. Cave deposits are the raw material for archaeological investigations, and Nottingham's caves have been no exception. Fragments and complete items of pottery, old tools, pieces of clothing, coins, and ornaments are among the detritus sifted from the rubble and debris in many of the caves – most notably in the series of excavations pursued by the Nottingham Historical and Archaeological Society. Some of these relics have provided evidence of by-gone lifestyles and local industries that were the elements of Nottingham's history and growth, while others can be dated to link the caves to events above ground.

Rumours of buried treasure have come to nothing, except for some gold coins that were found in 1991 in the Black's Head caves; they dated from 1824 and 1829, and were probably hidden in the cave by a thief who never had the opportunity to recover them.

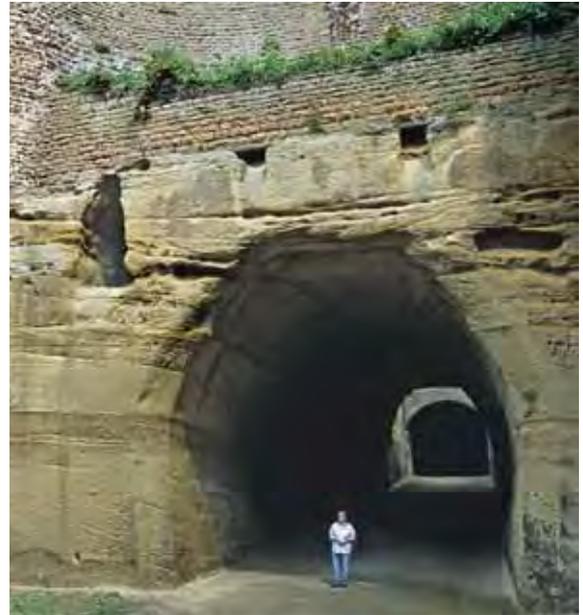
Once the historians have extracted their relics from the cave debris, the value and interest of a cave remains in its structure. The cave itself is a part of our local heritage; and the best way to protect a cave is to use it. This may sound like a conflict of interest, but the caves that are ignored or forgotten are those that are more readily damaged or destroyed in subsequent years.

The demolition of the old shops and houses along Drury Hill (to make way for the Broad Marsh Centre in 1968) was a tragedy that many remember and some should now regret. But the caves below did survive when they were protected by application of Ancient Monument status. In 1994, the caves were reopened as a visitor site (currently known as The City of Caves) and have become justifiably popular. From a reception area within the Broad Marsh Centre, a new stairway drops straight into the caves, which have been restored with displays to demonstrate their various phases of use as storage rooms, a tannery, pub cellars and air raid shelters. These already form the most varied group of linked caves within the city, but there is tremendous scope for future extension to them; an engineered route through the Western Caves,

then out through the original cliff, could provide a viable connection to the Willoughby House caves. This would further improve a splendid cave tour, and could constitute an even more significant tourist attraction within Nottingham.

Currently there are regular guided tours of Mortimer's Hole beneath the Castle and of the caves under Wollaton Hall, as well as access to the caves behind the Brewhouse Yard museum and under Shire Hall. Tours are also organised by volunteer groups, on a less frequent and more irregular basis, to the caves of Bridlesmith Gate and Sneinton Hermitage, and the Park Tunnel is readily accessible on a public footpath at the end of Tunnel Road.

Various other caves offer scope for small-scale development but really wait for the right opportunity. There are plans already under way to create access to the well preserved malt kiln caves under the old Plumtre House in the Lace Market, not far from the old Adams' Brewery caves that are extensive enough to be worth opening to visitors. Rouse's old sand mine is the most extensive cave in Nottingham, and it has considerable potential for becoming an unusual underground tourist site. The city council already



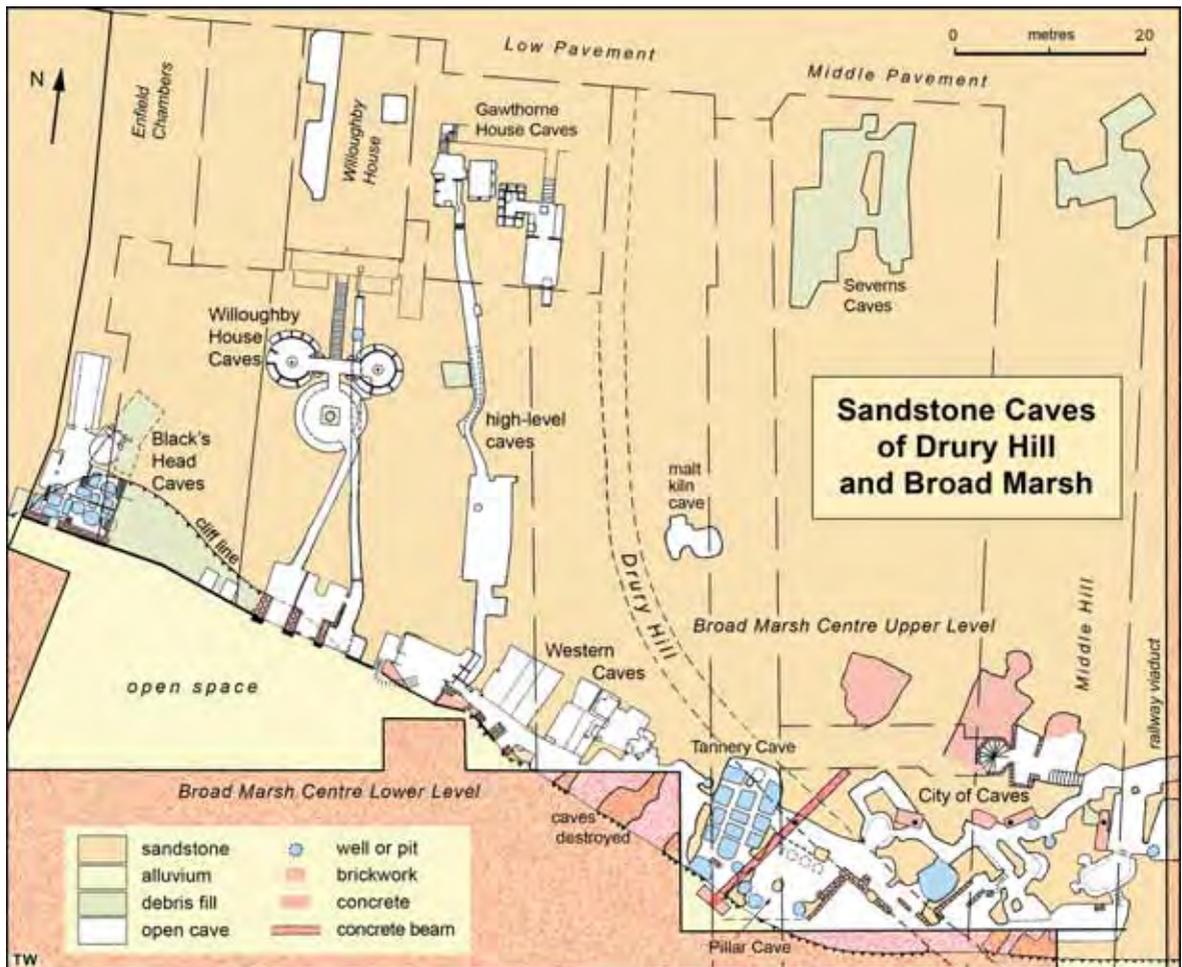
The grand entrance to the Park Tunnel, so accessible because it has a public footpath through it, though the older, smaller, high-level tunnel is not easily reached.

SANDSTONE CAVES OF NOTTINGHAM



Bold rock carving in the largest of the three circular wine cellars beneath the garden of Willoughby House.

The main groups of caves cut into the sandstone cliff where the old Drury Hill climbed into the old town from the floodplain. Many of these caves are now preserved beneath the Broad Marsh Centre, including the tourist caves currently known as the City of Caves.



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owns the Peel Street entrance, but any serious development of the site will have to be through the main entrance on Mansfield Road, and this is currently not an available option.

At least a dozen public houses in Nottingham still use their rock caves as beer cellars. In many ways they are still ideal, though some can be damp through lack of ventilation, and the health authorities are sometimes over-zealous with

regulations. The Trip to Jerusalem and the Hand and Heart inns both have some of their bars within caves. The very fine group of cellar caves under the Salutation Inn are no longer used for beer storage or as bars, but they are readily accessible to customers at certain times. Some other beer cellar caves can be seen by special interest groups who make prior arrangements with the pub landlords. Yet more may be



The Upper Cave Bar is one of the many popular bars in the Trip to Jerusalem, all cut back into the sandstone at the foot of Castle Rock.



Beer barrels are piled up in one of the cellar caves that are still in use behind the Trip to Jerusalem.

SANDSTONE CAVES OF NOTTINGHAM

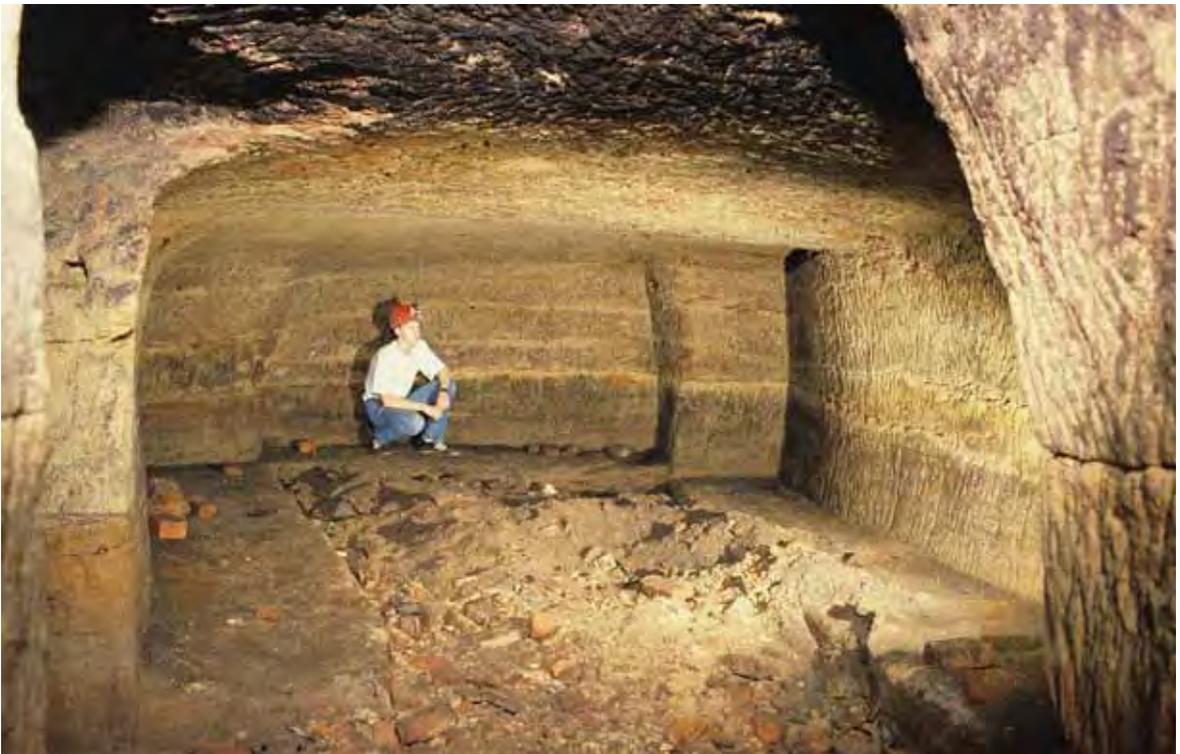
accessible when the presence of a cave is recognised as a positive asset at a site needing to attract visitors and customers.

This list of caves that can be visited is only short, and casual access to nearly all the other caves cannot be realised. There are serious and perfectly valid difficulties, due to conflicts of interest, where the caves are only entered through buildings that serve a totally different purpose. Fortunately, the historical value of a cave is preserved where it is only accessible through a manhole in the floor of a private office, but its tourist value is impossible to realise. Nearly all the caves referred to in these pages lie on private property; access is generally not available, and requests for casual visits are not encouraged.

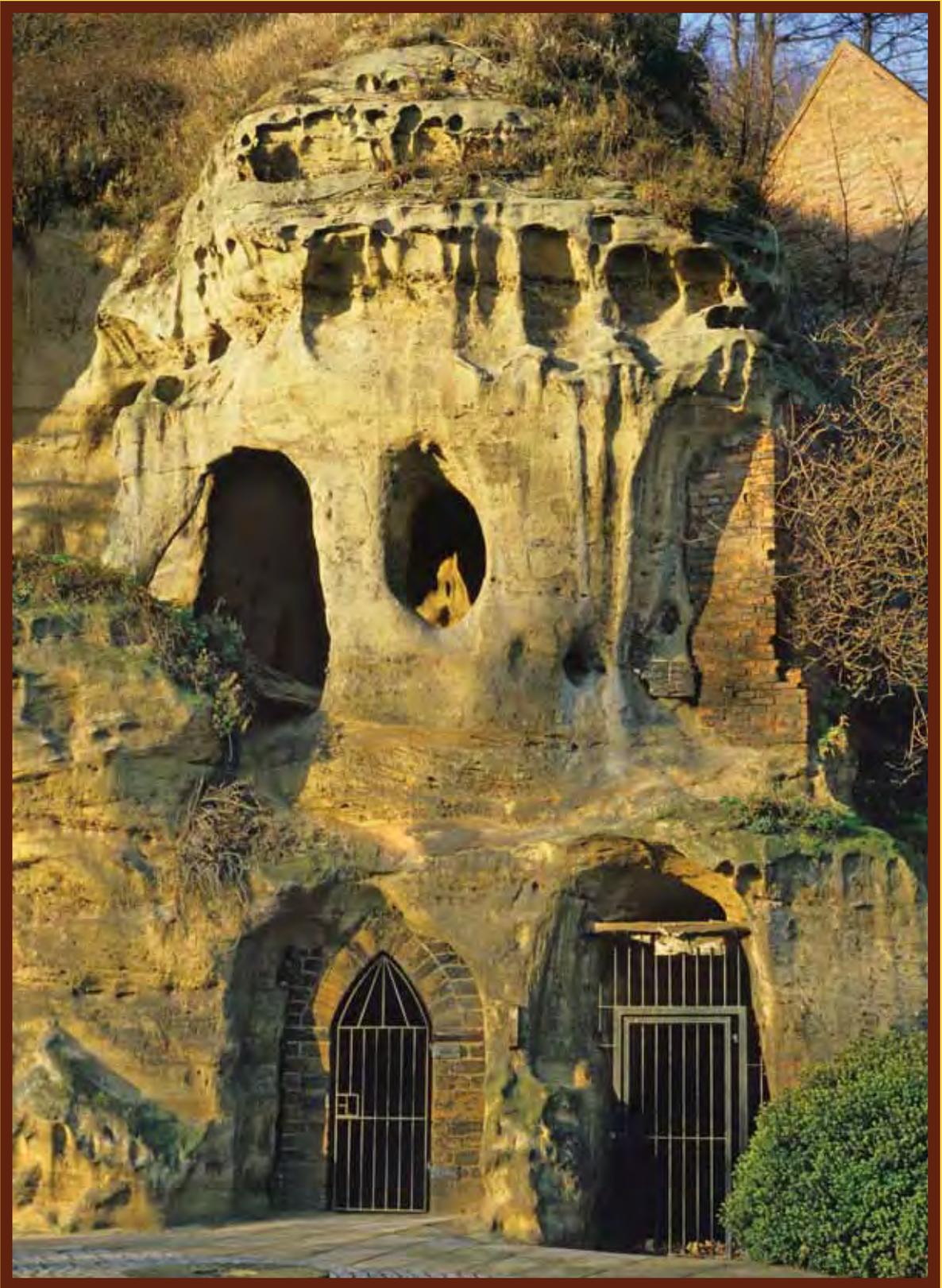
Beyond the pub cellars and tourist sites, the scope for utilising Nottingham's caves is rather restricted. A cave on Castle Road houses a shooting range, the cave garages along Newcastle Drive are still in use, and the old Guildhall caves have been used for fireman

training. Others are used for storage, but too many caves end up as little more than convenient dumping grounds. Plans have been announced, and then shelved, to install a night club in the old Burton's cold-store caves and also a sauna complex in the caves beneath the Commerce Square residential development. There were plans for the fine medieval cave under the old Pearsons' building to be used as a cafe or restaurant, but these have come to nought in the new development.

For the many other caves, where commercial development is not possible, the value lies in their historical record and their role in the environmental structure of Nottingham. Today this is increasingly appreciated, and the future looks brighter for selective conservation of more of the finest caves. It is only in a climate of greater awareness, by both the private landlords and the city council, that the sandstone caves will survive and will continue to constitute an integral part, and also a valuable asset, within Nottingham's urban heritage.



Deep beneath Clumber Street, a cellar cave with its barrel thralls, which was once part of the old Corner Pin public house, is one cave that has been lost, as it is now full of concrete.



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